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The Strategic Implications Of The Change From An Offensive Nuclear To A Defensive Space Based Strategy For The U.S. And The U.S.S.R.

by

©

Jorgen P. Kruger

A THESIS

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Thomas Keating
Supervisor

Date 7 May 1985

ABSTRACT

Since the end of World War II, the world has been haunted by the spectre of a nuclear Armageddon let loose by a conflict between the U.S. and the U.S.S.R. and their respective alliances. To ensure that this does not happen, each has been kept in check by what has been perceived as a strategic balance in nuclear weapon systems and the vulnerability of each state's population and industrial centres. One side of the nuclear balance cannot attack the other without fear of close to total destruction of its society, an idea encapsulated by the theory of Mutual Assured Destruction (MAD). As long as both sides remain relatively even in the strategic balance, stability of a sort is ensured.

However, time does not stand still and technology forces advances beyond the boundaries set by current strategic theory. Throughout history there has been and continues to be evidence of a shifting offensive/defensive military balance. An era of defence will be followed by an era of offence and each will generally be brought about by technological advances. The present era is no exception with pre-WW II being an example of defence and post WW II to the present an example of a

military balance favouring the offence. But once again technological advances linked with a dissatisfaction of MAD are pressuring for a change favouring the defence.

President Reagan highlighted in his March 23, 1983 Star Wars proposal what I feel will be of paramount importance in the future for strategic theorists. By linking ongoing research in beam weaponry with a well financed military effort to develop space systems suitable for continental defence, Reagan has forced political scientists and members of the military to reanalyse what has been previously denigrated as being too destabilising for the strategic balance.

Many questions come to mind when postulating theory for a new weapon system and to assist in answering them, I will outline what systems are presently considered, how they will be utilised and a possible time frame for their deployment. Once these matters have been covered, attention can then be placed on why the shift to space based weapons has occurred and the effects their deployment will have on the strategic balance. The analysis will be focussed on the historical nature of the change, state of the present strategic theory, and the implications on the arms race, arms control, deterrence, NORAD and NATO.

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List of Abbreviations

ABM	Antiballistic missile
ALCM	Air launched cruise missile
ASAT	Antisatellite
ASW	Antisubmarine warfare
BMD	Ballistic missile defence
BMEWS	Ballistic missile early warning system
CEP	Circular error probability
C_3I	Communication, command, control, intelligence
DEW	Directed energy weapon
DPC	Defence Planning Committee
EMP	Electromagnetc pulse
GBMD	Global ballistic missile defence
GEODESS	Ground based electro-optical deep space surveillance system
GLCM	Ground launched cruise missile
HIT	Homing interception vehicle
ICBM	Intercontinental ballistic missile
IRBM	Intermediate range ballistic missile
KT	Kiloton
LMI	Lightweight midcourse interceptor
LOAD	Low altitude defence systems
LOW	Launch on warning
MAD	Mutual assured destruction
MARV	Manoeuvrable reentry vehicle

MIRV	Multiple independently targeted reentry vehicle
MRBM	Medium range ballistic missile
MV	Miniature homing vehicle
NAC	North Atlantic Council
NATO	North Atlantic Treaty Organisation
NORAD	North American Aerospace Defence
NSC	National Security Council
NWS	North Warning System
OTH-B	Over-the-horizon backscatter
RAF	Royal Air Force
RV	Reentry vehicle
SALT	Strategic Arms Limitation Talks
SDI	Strategic Defence Initiative
SLBM	Submarine launched ballistic missile
SRAM	Short range attack missile
SSBN	Nuclear submarine
U.N.	United Nations
U.S.	United States
U.S.S.R.	United Soviet Socialist Republic
WTO	Warsaw Treaty Organisation
WW I	World War One
WW II	World War Two

CHAPTER I

Introduction

The study of international relations involves many complex and diverse factors of analysis. It includes economic, political and social factors interwoven to form a mesh of ideas, theories and paradigms that often foment internecine arguments among political scientists. Different approaches are taken and different levels of analysis are utilised to analyse the complexities of an ill-defined discipline. One of the most discussed topics in international relations which highlight the different approaches and often polemic squabbling is that of strategic studies.

Defined as the "art of the dialectic of two opposing wills using force to resolve their dispute,"[1] it has garnered more opinions since the end of World War II than perhaps most other fields of international relations. The majority of the argument has raged around deterrence and nuclear weapons but of late the focus has been changed to include another aspect of the continuing clash between the United States and the Soviet Union. Emphasised by President Ronald Reagan's Strategic Defense Initiative (SDI) there has been a shift towards new strategic thought formulated on the implications of defensive, space based weapon platforms. In order to shed light on the discussion, this paper will analyse the relevant weapons technologies and the effect they will have on the strategic balance theoretically and practically. Perhaps it will be proven to the reader that a change in strategic thought as important as that brought about by the emergence of nuclear weapons is now unfolding.

Since the end of World War II, the world has been subject to the political whims of a superpower conflict that has refused to take the ultimate step towards a direct armed clash. The U.S. and the U.S.S.R. have faced each other in opposition in all areas of the globe and yet the final ideological resolving confrontation has not occurred; much to humanity's relief.

The Berlin Blockade in 1948 was resolved by a massive American airlift to Berlin and political pressure on the Soviet Politburo. A direct recourse to arms was negated by more peaceful means of dispute settlement, unlike the situation in Korea in 1950 when the U.S. under the guise of the United Nations banner applied direct military force to the U.S.S.R.'s puppet, North Korea. Though the war cost many lives and eventually included China, the two superpowers never came face to face in a final showdown. Not until the Cuban Missile Crisis of 1962 did the U.S. and the U.S.S.R. face each other directly, but in that instance Nikita Khrushchev 'blinked' and backed down to John F. Kennedy's obdurate stand and the American's regional military superiority.

The two powers have continued up to the present to become involved in lesser conflicts for various reasons but mainly to counter perceived thrusts into their spheres of influence on the part of the other, or to strengthen the will of failing allies against the ideology of the other. The U.S. has intervened or assisted in Lebanon, Israel, Grenada, The Dominican Republic and Vietnam for instance, while the U.S.S.R. has done much the same in Angola, Ethiopia, Czechoslovakia and Afghanistan. Neither state has, or is willing to countenance usurption of power in any area and both are willing to use military force, short of direct conflict with the other, to reinforce their opinions or interests.

The lack of military conflict should not serve as evidence of a lack of any other form of conflict but on the contrary should serve as evidence of an as yet ongoing political conflict that has not dissolved into outright, direct war. The political conflict between the U.S. and the U.S.S.R. has gone through many phases since 1945 but neither has yet to employ war as a non-peaceful means of diplomacy against the other.[2] The temptation has been there but political leaders have refrained and instead heated up or cooled off the relationship between the two powers in response to political pressures from domestic or international sources.

The period from 1945 to the mid-1960's has come to be known as the Cold War between the U.S. and the U.S.S.R. In this time span, the two power's political relationship was one of distrust and misunderstanding thus leading to confrontation in many political spheres. Beliefs in the Bolshevik red menace and American capitalist imperialism led to the formation of antagonistic policies on both sides which would eventually lead to confrontation. The U.N. serves as a prime example of the aforementioned tendency as each power would suggest policies that the other would have to veto. The confrontational attitude climaxed with the Cuban Missile crisis in 1962 in which the political climate almost deteriorated into nuclear war.

With the stimulus of the near climactic Crisis, both powers for various reasons were willing to adopt a more conciliatory stance towards the other and dialogues were entered into in a more peaceful climate. The political relationship entered into a period of detente which was to last to the end of the 1970's. In this period, emphasis was placed on arms control negotiations and increased bilateral discussions of other political problems. Unfortunately detente would not survive the endemic distrust and misunderstanding of each other's actions. Heightened by continual leadership changes in the U.S.S.R. and a sense of retrenched conservatism in the U.S., the period up to the present has been marked by political dogmatism and conflict. There are still attempts at bilateral talks on numerous topics but they continue under a shroud of increased political confrontation and an increasing fear of possible military confrontation.

The willingness of the two superpowers to directly confront one another in a military clash is attributable to the presence of fear in each state's leadership and general population. It is a fear of near total destruction of one's country induced by nuclear weapons. It is not an emotion monopolised by the U.S. and the U.S.S.R. but is endemic to any state or people that could possibly be caught up in or affected by a nuclear exchange between the two states. Since the utilisation of the first atomic bombs against Japan in 1945, the fear of total destruction has grown proportionately and globally with the continuing advancement in nuclear weapons technology. As the weapons have advanced or increased in quality and quantity and as the possible repercussions of their use on mankind is studied and analysed, the general perceptions of an all out nuclear war have spread fear of death and destruction as no other weapon system in history.

The first atomic bombs dropped on Hiroshima and Nagasaki were physically large gravity bombs of relatively low yield (12 -20KT) deliverable only by what was at the time a large, slow, bomber airplane. Though crude in design, each bomb was still responsible for over 50,000 deaths each and at least the same number of injured.[3] These one bomb raids compare in casualties with the massive fire storms created by the combined RAF and U.S. Eighth Air Force in the Dresden Raids.[4] These two bombs were given credit for ending the war with Japan and the saving of possibly millions of Allied lives, but at the same time they were the portent of a revolutionary new weapons technology which would advance in sophistication to the point where one thermonuclear warhead delivered by an intercontinental missile would have the capability to destroy any city in the world.

The development of nuclear weapons was not a smooth, carefully orchestrated process but rather a process of fits and false starts for the U.S. and the U.S.S.R. Often a development by one would only be in response to the development by the other of a new or modified weapon system. Interservice rivalry for finances or prestige would dictate the direction of development or a change in political leadership could affect the speed, direction and type of development undertaken. Military, social, economic and political factors would all combine to influence in one fashion or another the development of the nuclear weapons technology that presently holds the world in its grip of fear.

Though the development process could be defined as inefficient and wasteful, the current stock of nuclear weapons is just the opposite in terms of accuracy, speed and range. On the other hand a strong argument could be made concerning the excessiveness of quantity and destructive power for the defined purposes of use. Regardless, the nuclear weapons are present in large numbers in the American and Soviet arsenals and they cannot be ignored or made light of. The following tables will break down each superpower's respective nuclear forces.

Table I. American Strategic Nuclear Forces[5]

	1953	1963	1973	1979	1984
ICBM	-	284	1054	1054	1045[a]
SLBM	-	112	656	656	568[b]
Long Range Bomber	-	639	397	365	272[c]
Total Warheads	-	3000+	6784	9200	8637+

continued...

Table I continued.

a. There are current plans to update the present ICBM's with the introduction of 100 MX missiles, each of which can carry ten warheads.

b. There are current plans to update present SLBM's with the introduction of the Trident D-5 missile, each of which can carry six warheads with a range of 6000 miles.

c. Currently consists of B-52 bomber in various configurations but 100 B-1B bombers are scheduled to come on line by 1986. A B-1B can carry five times the payload of the B-52.

Table II. Soviet Strategic Nuclear Forces[6]

	1953	1963	1973	1979	1984[a]
ICBM	-	35	1575	1398	1398
SLBM	-	-	628	1028	980
Long Range Bomber	-	100	140	156	143
Total Warheads	-	700+	2200	5300	8342

a. Accurate detailed information on weapons development is not available but it is known that the ICBM and SLBM are being constantly updated and modernised and a new long range bomber, the Blackjack A, is being developed to replace the older bombers. The Blackjack is similar to the U.S. B-1B.

There is a great deal of controversy surrounding the exact number of weapons and warheads but it is safe to say that the above tables give a representative idea of the quantity involved on both sides. The qualitative factor, measured in the relationship between range and accuracy, is not given to being easily quantified but it is generally agreed upon that in contrast to the past, the U.S. now holds only a marginal lead in the quality of its strategic nuclear weapons and the lead is almost completely offset by the U.S.S.R.'s use of larger warheads in its missiles. As mentioned in the notes to Tables I and II, the present level of strategic forces is not static but constantly undergoing change in one factor of development or another. This trend, as it is presently headed, would eventually lead to fewer missiles with more warheads that are extremely small, accurate and fast. For example, the dimunitive cruise missile is expected to attain supersonic speeds by 1990 and the use of the NAVSTAR guidance system will entail accuracies within ten metres.

Of greater interest than nuclear weapons technology is nuclear strategy or in other words the planned use of strategic nuclear weapons. Much like nuclear weapons technology, nuclear strategy has progressed spasmodically since the late 1940's. Even though the concept of deterrence has stood as the core idea of nuclear strategy, there has been disagreement among policy makers about how to attain deterrence with the nuclear weapons then present. Not only were there problems formulating a suitable strategy under 'normal' political conditions, but complicating factors such as

Arms Control Talks in one form or another were entered into to control strategic nuclear weapons development and deployment. Thus the situation arose of policy makers attempting to formulate strategy while new and better weapons were being developed and at the same time the same policy makers were attempting to control nuclear weapons and yet retain a plausible strategy.

At the end of World War II, when the first atomic bombs were used, there was no concept of a special strategy for their use. They were considered as merely conventional weapons with a larger bang and thus more effective in the role of what had come to be known as strategic bombing. The results of the two explosions and the realisation that nuclear weapons were altogether of another order above conventional weapons ensured the acknowledgement in the U.S. that new ideas or strategies would have to be formulated. This factor and the perceptions of U.S. policy makers concerning the growing Soviet threat, particularly those of John Foster Dulles, led eventually to the concept of massive retaliation.

Massive retaliation was basically a trip wire strategy that called for the U.S. to launch a large proportion of its strategic nuclear force at the U.S.S.R. in response to a Communist armed incursion against the U.S. or any of its allies. It was felt in the U.S. that the threat of massive destruction caused by such an attack would deter the U.S.S.R. or any of its allies from embarking upon any adventures disadvantageous to the U.S. The strategy was thought to have some merit as long as the U.S. had a distinct superiority in strategic nuclear weapons and the leaders of the U.S.S.R. perceived that there was the will in the leaders of the U.S. to use the weapons.

By the end of the 1950's the U.S. may have had the will but lacked an overpowering superiority as the U.S.S.R. had developed new strategic weapon systems (ICBM's), ahead of the U.S. The situation had changed such that if the U.S. now launched a massive first strike, the U.S.S.R. had the capability to retaliate in kind. Under these conditions, a new strategy was formulated to account for the changing parameters of the nuclear balance between the U.S. and the U.S.S.R. and the changing parameters of the military balance between the North Atlantic Treaty Organisation (NATO) and the Warsaw Treaty Organisation (WTO), their respective European military alliances.

In place of massive retaliation, the U.S. adopted the strategy of mutual assured destruction (MAD) to justify the nuclear balance of strategic weapons. At its most fundamental level, MAD dictated that in case of nuclear war, both sides, regardless of who struck first, would be physically and economically destroyed by the numerous strategic nuclear weapons. Neither state was invulnerable and therefore both were deterred from attacking the other. To protect its NATO allies, the U.S. extended its nuclear umbrella to include Europe as well as North America. Any armed attack on North America or Europe was now included in the MAD strategy. It was necessary for the U.S. to protect Europe with nuclear weapons as the WTO enjoyed a large conventional force superiority in Europe over NATO. Even though under the U.S. leadership, NATO had accepted the strategy of flexible response which was to permit NATO to meet any threat to its members from the WTO with an appropriate level of force, be it conventional, tactical nuclear or strategic nuclear, there was and continues to be a lack of political will to meet standing force requirements. Thus there is still a predominant dependence on the threat of MAD to deter U.S.S.R. aggression in Europe.

Since the advent of MAD and flexible response, other strategies have been postulated but not accepted to any large degree. The lack of nuclear war in the 1960's, the 1970's and the 1980's has served to illustrate deterrence through the strategy of MAD. The lengthy period of dominance by MAD has led to complicated attempts at arms control. Since it is accepted that either state can destroy the other many times over, talks have been entered into in three categories.

> Those concerned with prohibiting the deployment of particular weaponry in hitherto non-used areas; thosebroadly concerned with the management of crises; and those concerned with restraining the growth in the quantitativeand qualitative aspects of nuclear weaponry, both vertically and horizontally.7

The first category is represented by the 1959 Antarctic Treaty, the 1967 Outer Space Treaty and Treaty of Tlatelolco, and the 1971

Sea Bed Treaty. The second category is represented by the 1963 "Hot Line" Agreement and the 1971 "Hot Line" Modernization Agreement, the 1971 Nuclear Accidents Agreement, the 1972 High Seas Agreement and the 1973 Nuclear War Prevention Agreement. The third category has the largest number of negotiations and is represented by the 1963 Partial Nuclear Test Ban Treaty, the 1968 Nonproliferation Treaty, the 1972 SALT I ABM Treaty, the 1972 SALT I Interim Offensive Arms Agreement, the 1974 Threshold Nuclear Test Ban Treaty (not ratified), the 1976 Peaceful Nuclear Explosions Treaty (not ratified) and the 1979 SALT II Offensive Arms Agreement (not ratified).[8]

It is evident from the number and nature of arms control negotiations that attempts to control nuclear weapons were a serious endeavour on the part of American and Soviet policy makers in the past and the policy continues to the present with plans for future talks being agreed upon by George Schultz and Andrei Gromyko of the U.S. and the U.S.S.R. respectively, in January of 1985. A large question remains though concerning the validity and effectiveness of arms control talks. For the amount of rhetoric, results in practical terms have been abysmal. All of the agreements, treaties and conventions have been ineffective in stopping the modernisation and production of nuclear weapons to the listed high levels (Tables I and II). It is for this reason and others that a new direction is being taken by the U.S.

and the U.S.S.R. to circumvent the destructive capabilities of nuclear weapons.

A symbol of the direction is President Reagan's March 1983 SDI or Star Wars speech. With the assistance of new technological weapons such as particle beams, lasers, and hypervelocity guns, an attempt will be made to mount an effective defensive system against strategic nuclear weapons. Needless to say the hue and cry of anti- and pro- SDI backers has been loud and incessant since the speech and increasingly polemical. Unfortunately most of the arguments fail to deal with the real issues of what I would call the new defensive trend and instead focus on the pros and cons of a symbol of the trend. In contrast to the present discussion, I am not going to focus on the SDI but what it stands for; a new strategic direction.

I am going to make the assumption that the policy makers in the U.S. and the U.S.S.R. will continue the historical trend of arms development, will develop the new technologies and will position them into space as strategic defensive systems within twenty years. It seems at first light a presumptuous assumption. Upon consideration of the present level of development of the new technologies, the failure of arms control talks, the nature of the historical trend in arms development and the inherent weaknesses of present nuclear strategy, the assumption is neither presumptuous nor farfetched but necessary to focus on the main theme of the thesis.

I want to analyse the effects on the strategic balance and to assess the real implications of the weapons vis-a-vis the U.S., the U.S.S.R. and their respective military alliances. Since the end of World War II, strategy and weapons development have been focussed on deterrence and offensive nuclear arms and what I want to know is what will happen to these if defensive weapons become predominant and a new strategy is required? Will revolutionary changes be required as with the development of nuclear weapons or will the strategy of deterrence merely undergo minor changes to assimilate the new technology?

As the thesis will be focussed on the future and is only meant to be an introduction to a topic above and beyond a pro or con SDI stance, it will have to be general in context rather than issue specific. The subtopics of the paper would warrant a major work in themselves but to give an idea of the general complexity of the issue at this point in time, it is realistic to attempt to cover so much in such a manner and then perhaps focus on each aspect of the discussion in latter works.

Before commencing with the main body of the work it is important to highlight certain pertinent features of such an endeavour. Besides personal limitations introduced by the author's personal bias and topic selection, there are information limitations to be outlined. Due to the nature of the topic and the nature of the information regarding aspects of the technology and possible future government actions and discussions, the present governments are unwilling to declassify all available data. Therefore mistakes and miscalculations are highly possible and the thesis will have to be slanted on the basis of a greater availability of American data as compared to Soviet data. An attempt will be made to deal with each side equally but it should be accepted beforehand that the thesis will be written with a dearth of Soviet information.

Notes

1. A. Beaufre, Introduction to Strategy, (New York: Frederick A. Praeger, Inc., 1965), p. 22.

2. For a historical analysis of the U.S.S.R. and U.S. relationship from a Soviet and American point of view, see: N. Sivchev, N., Yakovlev, Russia and the United States, (Chicago: The University of Chicago Press, 1979) and J.L. Gaddis, Russia, The Soviet Union, and the United States: An Interpretive History, (New York: John Wiley and Sons, Inc., 1978).

3. R.E. Dupuy, T.N. Dupuy, The Encyclopedia of Military History, (New York: Harper & Row, Publishers, 1970), p. 1198.

4. Dupuy, p. 1117.

5. The information in the table was drawn from A.M. Cunningham, M. Fitzpatrick, Future Fire, (New York: Warner Books, Inc., 1983), M. Sheehan, The Arms Race, (Oxford: Martin Robertson & Company, Ltd., 1983), N. Polmar, Strategic Weapons: An Introduction, (New York: Crane, Russak, & Company, Inc., 1975) and The International Institute for Strategic Studies, The Military Balance 1983-1984, (London: IISS, 1983).

6. Ibid.

7. J. Baylis, et al., Contemporary Strategy, (New York: Holmes & Meier Publishers, Inc., 1975), p. 102.

8. Baylis, pp. 102-108, and B. Russett, The Prisoners of Insecurity, (San Francisco: W.H. Freeman and Company, 1983), pp. 172-173.

CHAPTER II

Defensive Weapon Systems and Technology

Prior to discussing effects on the strategic balance or the implications of the space based weapons, it is important to have a basic understanding of the weapons involved and how they might be utilised. Much as it is necessary to understand the fundamentals of fission and fusion and the various components of nuclear weaponry to be able to begin to comprehend nuclear strategy, it is just as important to be conversant in the space based weapons technology. Knowing the limitations, present states of technology and future trends in the development of weapons will make it easier to analyse a strategy based on those weapons. Unfortunately easier is only a relative term particularly when attempting to look into the future as this paper does. Unforeseen advances or difficulties in weapons development could make the question of strategic change in twenty years redundant or possibly relegate this paper to the trash heap, but it is still pertinent to understand the basics of a technology that may affect the strategic balance drastically whether it be in ten, twenty or even fifty years.

Presently, none of the about to be discussed weapon systems have been tested in space or even been built in a space compatible mode, however, research and development is ongoing. The basics of the pertinent technologies are understood but the step from laboratory test equipment to actual weapons deployment is difficult and expensive. Because of this factor, the weapons systems are based only on educated guesswork and not actual physical models. This means that as the weapons are only conjecture for the most part, their possible strategic deployment is tied to extrapolations of present test systems and trends. A revolutionary discovery in the next decade could outdate the present conjecture, but as this is impossible to divine, the present guesses will have to suffice.

The present research and development of space based weapons systems is focussed on directed energy weapons, hypervelocity guns and conventional chemical propelled missiles. All of these systems are being researched as if they would be deployed in a dual mode as antisatellite (ASAT) weapons and antiballistic missile (ABM) weapons. Before analysing the two roles in depth, each system type will be described in terms of its basic technology, its present capabilities and limitations, and its future areas of development. Once this has been accomplished, the future modes of deployment will be analysed, keeping in mind the technological aspects of each weapon system.

The first weapon system to be discussed will be the chemically propelled missiles with a non nuclear warhead. As a system, it is the most advanced in terms of testing and development. It is possible that with the required funding and committed production drive, an effective system based on chemically propelled missiles could be deployed in seven to eight years.[1] In contrast to previous systems, the present class of ABM would not have to depend on a nuclear warhead exploding in or out of the atmosphere to be effective, as advances in precision guidance over the last decade have increased the accuracy of such missiles greatly. Due to the increased accuracy, the present and future missiles would depend on ramming their objectives or else the conventional warhead would be exploded close to their targets thus showering it with many miniature projectiles and destroying it. The U.S. is developing both systems whereas the U.S.S.R. has only so far focussed on the latter exploding method.

The U.S. has to date researched and started to develop four weapon systems based on the above two techniques. Only one of the four is actually space based. The other three are pertinent as their specific missions would entail use as part of an overall ABM or ASAT plan. The U.S. Army's homing interception (HIT) vehicle is an example of the conventional exploding warhead, the U.S. Airforce's miniature homing vehicle (MV) and lightweight midcourse interceptor (LMI) [2] utilise the ramming technology and the postulated global ballistic missile defence (GBMD) system will possibly utilise a conventional exploding warhead and the ramming technique.

The HIT vehicle was tested on 10 June 1984 when it was launched from the Kwajalein Atoll in the Pacific and then intercepted a dummy Minuteman warhead at an altitude of more than 100 miles. [3] The vehicle depends on a high acceleration two stage rocket guided by a terminal homing infrared radar to bring it close enough to explode and spray the reentry vehicle (RV) with high velocity pellets. The pellets on contact would either knock the RV off course or destroy it. Besides being used as a mid course ABM interceptor, the HIT vehicle would have the capability to destroy low level satellites.

Unlike the LMI and the HIT vehicle, the Airforce's MV was solely for an ASAT capability and is air launched from an F-15 jet fighter at approximately 70,000 feet rather than ground launched. The LMI and MV are similar though in that their guidance systems are more accurate than that used in the HIT vehicle and they both depend on a direct hit to destroy their targets. A description of the MV operating procedure will clarify how the accuracy is achieved for both the MV and the LMI.

> ... the MV is spun up to 20 revolutions per second for stabilization. It then utilizes a laser gyro and liquid helium cooled cyrogenic infrared sensors to fire small solid rocket conector motors to track the target spacecraft. In flight, the missile would speed towards its quarry at eight miles plus per second.
>
> After separating from the missile, the warhead would lock onto the target with eight telescopes in its nose that gather infrared radiation and focus it on a supercooled sensor at the heart of

> the warhead. Fifty six small steering rockets would keep the warhead on a collision course. Destruction of the target would occur when the miniature homing vehicle smacked into the Soviet spacecraft. 4

Neither system has been proven better than the other yet, so both are still considered viable for the GBMD system. The GBMD system would consist of a number of satellites, each of which would be armed with 50 kill vehicles and would depend on passive surveillance sensors and a laser radar system to detect and identify targets. 5 The kill vehicles would travel at speeds up to 3000 feet per second with respect to the launcher satellite and would contain the aforementioned guidance technology in their terminal stage. They would be launched at Soviet ICBM's, while the ICBM's were still in their boost and/or busing phase with hopes of destroying them before they deployed their multiple RV's.

No great technological advances are required to deploy full scale systems of the above weapons but even so there are weaknesses or limitations that affect their capabilities and utilisation. The systems would be subject to numerous countermeasures to one degree or another and all of the conceived systems would have to be deployed in uneconomically large numbers because once a missile is launched, it cannot be retargeted or reused. In addition, the GBMD system especially would require a large number of satellites to be able to cover adequately the total Soviet ICBM launch area and to be able to protect itself from Soviet ASAT weapons.

The countermeasures these weapons systems would be susceptible to can be broken down as follows: flooding, blinding, evasive action and target deception. Flooding would entail the use of a large number of decoy targets. In the boost phase, dummy ICBM's could be launched. In the midcourse phase chaffe, dummy RV's and balloon decoys could be used and in the terminal phase, electronic signals could be used to send dummy electronic signatures of RV's. Blinding would consist of a method to counter the infrared sensors. An exoatmospheric nuclear explosion would effectively blind the infrared sensors and unless the weapons computers were hardened, the electromagnetic pulse (EMP)[6] would destroy them and effectively blind the weapons. An RV that was able to manoeuvre could neutralise the guidance unit in a missile. A small trajectory change at the right time would cause a total miss by the ramming type of missile. On the other hand, if the missile is deceived as to the whereabouts of its target by electronic or physical measures, all of the guidance systems would be of little avail. Electronic countermeasures would consist of sending false signals and hiding the real targets. Physical deception could be accomplished by making one missile on target look like something else or in the case of the boost phase where the infrared sensors depend on the tail of flame from the ICBM for guidance to the missile, the flame could be baffled or hidden.

As is evident then, the U.S. chemical propelled missile systems are far from invulnerable or from being a 100% effective defence system when considered alone. The same can be said of the very limited effort in this area of technology by the U.S.S.R. When comparing missiles of the likes of the HIT vehicle, the LMI and the MV, the Soviets still depend on nuclear tipped warheads to engage RV's. They do not seem to have developed, as of yet, the necessary guidance technology to duplicate the American's missile endeavours. However, the Soviets have developed an ASAT satellite "that is equipped with clusters of podded miniature attack vehicles, which are outfitted with infrared homing systems" [7] that function much as the HIT vehicle does, depending on multiple small projectiles exploded into the path of the target to destroy it. Unfortunately for the Soviets, the system not only suffers from the limitations of U.S. weapons previously listed, it is limited even further by other factors. The system is launched into orbit by an easily detected large rocket and once in orbit, the system becomes a target for the numerous U.S. ASAT capable weapons. Its orbital flight path is also limited in such a manner that it can only destroy low level satellites in a similar orbit where few American satellites are. [8] The system works as an ASAT weapon but it is an extremely slow and inefficient method of destroying a large number of enemy satellites.

As can be noted then, present missile technology has advanced since the advent of the first ABM missiles in the 1960's but there are still numerous limitations in these weapon systems. Chemical propelled missile systems alone do not therefore form an adequate defensive system for either the U.S. or the U.S.S.R. They would be effective enough to destroy a large percentage of ICBM's but not to reduce the amount of destruction to an acceptable level. Consequently, other weapon systems are being considered which depend on the further research and development of future weapons technology rather than present technology. The first of the new weapons to be discussed will be the hypervelocity gun as it seems to be closest to possible deployment compared to directed energy weapons.

The only information available on hypervelocity guns and directed energy weapons comes from U.S. sources and therefore it is impossible to describe accurately any possible Soviet programs in these areas. It is known that the U.S.S.R. is developing these types of weapons but how far along in the developmental and testing phase they are is unknown.

The hypervelocity gun is also known as the rail gun or more accurately the electromagnetic launcher. It is being considered for use primarily as a boost or post boost phase ABM weapon. The gun as a self defending satellite would either be launched into space by rocket or placed in orbit from the space shuttle orbiter.

In either case it would be in a low orbit, between 150 and 2000 kilometres[9] around the earth. Each satellite or gun would be able to launch 1 to 3 shots per second imparting a velocity of around 20 kilometres per second to each projectile which would weigh one to two kilograms.[10] The target would be destroyed when the projectile struck it at a very high velocity.

An electromagnetic launcher works on the principle that when the gun is fired,

> a current applied to one rail passes through a metallic film fuse at the base of the projectile. It instantly vaporizes it, creating a plasma and passes to the other parallel rail to complete a circuit and produce a power of around 1 million amps. The current in the plasma creates an electromagnetic field which reacts against the one in the rails. The electromagnetic field is forced forward, accelerating the projectile in front of it in a straight line guided by the rails.[11]

Current technology uses small strands of copper or copper tungsten to achieve speeds of 8 kilometres per second and can only fire one projectile per hour but the optimal parameters are technologically within reach within the next decade.

The main limitations on the hypervelocity gun system are inherent to it being deployed as a network of satellites around the earth. The lower a satellite's orbit, the more limited is the area it can effectively cover and therefore a larger number of satellites are required to guarantee that an adequate number are always in station over the target country. If fewer satellites are used at a higher altitude, then the range is increased and the chances of missing the target increase proportionately. Another mark against the hypervelocity gun is its relatively slow speed when compared to directed energy weapons which operate at the speed of light (300,000 km/sec).

The hypervelocity railgun technology is leaps and bounds beyond that required for chemically propelled missiles but is still relatively straightforward as compared to directed energy technology. The railgun would operate at much higher velocities and at greater ranges than present missile systems thus increasing the effectiveness of a strategic defence system which employed it. Combined with the previously discussed missile defence system though, there would still be limitations which would not ensure an adequate defence. To remedy such a problem, research is being stepped up in the field of directed energy weapons which is again a leap and a bound above railgun technology.

The greatest expectations in terms of strategic defence are being held for directed energy weapons (DEW). With the ability to deliver a large amount of energy on a small target at a great distance at the speed of light, proponents of DEW argue that the end of nuclear war is nigh. Great hopes are based on what is currently a primitive level of development. DEW's, which consist of particle beam weapons and laser weapons, have only been under research and development for about twenty years and therefore still suffer from many technical unknowns. The basics are understood but the knowledge to extrapolate the basics into effective weapon systems is still limited or missing altogether. A strategic defence utilising lasers may be viable within twenty years and particle beam weapons are expected to mature even later than that. Plans for both types of DEW revolve around using them as an ASAT weapon or as an ABM weapon in the boost and post boost phase.

High energy lasers, (light amplification by stimulated emission of radiation), which are being considered for defence purposes, are the combustion-driven gas lasers, the electrically excited gas lasers, the free electron lasers and the X-ray lasers. The last two hold the greatest promise but the least is known about them. Generally lasers rely on an input of energy into a medium which is forced to emit photons. The photons strike other atoms which in turn release more photons in the same wavelength and direction. The shorter the wavelength, the more powerful the laser. The waves of photons are then bounced back and forth through the laser by means of mirrors until they gain enough energy to exit the laser as a coherent, powerful beam of energy. The beam of energy is focussed on a target by a "large, rugged, highly reflective and optically perfect mirror "[12] which is dependent on the wavelength to determine its size as a shorter wavelength requires a smaller mirror for focussing.

The combustion driven gas lasers depend on the chemical reaction from the lasing medium for the energy required to produce the laser light. The favored mediums for this type of laser are carbon dioxide and hydrogen fluoride which produce beams in the mid-infrared wavelengths. The more powerful electrically excited gas lasers or excimer lasers depend on electrical energy to excite the inert gas medium to produce a beam in the ultra-violet wavelengths. Similar to the excimer laser, the free electron laser requires electrical energy but unlike the excimer laser, the free electron laser does not depend on a chemical medium for its source of photons. Instead, electrons from the electrical source "are forced into an accelerator and then into a magnetic field where they lose energy to a photon field as they leave. A portion of the beam's energy is recoverable and is used to accelerate the next collection of electrons."[13] The lack of medium permits the free electron laser to be tuned to different wavelengths generally between the range of the two gas lasers. An even shorter wavelength and therefore more powerful one is the X-ray laser. Dependent on a small nuclear explosion for energy, the X-ray laser cannot use mirrors to reflect the wave back and forth but instead relies on thermal X-rays generated by the explosion to stimulate the emission of X-radiation from the atoms of thin fibres which surround the nuclear explosive. Consequently the beam is not as coherent as the other lasers and is wont to diverge into a large beam with a greater distance travelled.

The first three laser types depend on a strong beam of energy striking a target at the speed of light, dwelling on one spot and burning or melting its way into the insides of an ICBM or satellite to destroy it. If the laser beam is pulsed, in that the beam strikes like multiple hammer blows, then it is more effective in terms of shorter dwell time and destructive power. The X-ray, on the other hand, strikes its target as one pulse only which is absorbed into the outer skin, blowing off a thin surface layer. This has two effects on the target. First, the target as a whole would recoil and second, the skin would be subjected to an abrupt pressure wave that could cause the skin to shear at its supports and damage the target's interior.[14]

Though lasers hold great promise as effective ASAT and ABM weapons, the present level of technological development is rife with shortcomings and limitations that must be considered. There are problems in the characteristics of the weapons themselves and there are problems facing the systems in the form of countermeasures, in addition to the limitations discussed in the previous two systems.

Depending on where the laser beam is fired, through the vacuum of space or through the atmosphere, it suffers from problems of propagation. In space the beam could travel thousands of kilometres because light travels without impediment in a vacuum, however the beam would diverge as a consequence of the wave nature of light. To reduce divergence, which is inversely proportional to the frequency of the laser light and the diameter of the aiming mirror, a higher frequency or a larger aiming mirror is utilised. This causes problems though in that the mirror must be highly reflective and optically perfect to a degree beyond present capabilities. The stringent mirror parameters also make for extremely vulnerable targets themselves. Any degradation of the mirror would render it useless. A laser beam in the atmosphere suffers from an even greater number of difficulties. Molecules of the air and particles of matter in it (dust, water droplets, smoke) can scatter or absorb a laser beam such that the beam cannot propagate even over a short distance. Also, turbulence in the air causes rapid changes in air density which deflect or disperse a beam even on a clear day. Another difficulty is that as a beam travels through the air, it heats the air up. The heated air is less dense than the surrounding atmosphere and as light beams bend away from the less dense air, the beam diverges in a phenomenom called thermal blooming. The final limiting factor in the atmosphere is the problem of the beam creating a plasma by ionising the surrounding air which eventually absorbs the beam. Perhaps the greatest inherent difficulty lies in the energy requirements of space based laser systems. X-ray lasers use their energy up in one explosion and are only good for one shot, but the others, utilising present technology, require large sources of power for each separate laser to be effective against a mass ICBM launch. These sources of power must be lifted into space on launchers not presently available and once in space serve as a large target for counter defensive forces.

The measures available to counter laser beams are directly related to the nature of the beam and the necessary dwell time a laser beam takes to destroy a target. As a laser beam is a light beam, it can be easily reflected by a shiny surface or absorbed by an ablative coating on an ICBM or satellite. If a satellite was sheathed in mirrors or an ICBM was highly shone, the beam would be reflected harmlessly away. If an ablative coating was used, the laser beam would never come into contact with the skin of the target. Similarly since the beam needs to dwell on one spot to be most effective, a hardening of the skin is possible such that the beam could not burn through. By imparting a spin to the missile or satellite, the beam would not be able to focus on a single spot but would have to heat a strip around the missile to destroy it, thus requiring more time and power. As lasers are expected to be used mostly in space because of the previously stated problems, a possible countermeasure against them would be to keep the ICBM's out of space and ensure they stay within the atmosphere. All in all, there is a formidable panoply of problems facing the development of laser weapon systems. Perhaps partly in response to this, research has been ongoing into a type of DEW which observers see to be the ultimate defensive system, the particle beam weapon.

The particle beam weapon lags behind the high energy laser in development but is still considered the follow on weapon to the laser because of its higher potential lethality. Gains in numerous technological areas are required before an effective space compatible weapon system is ready for deployment but the basics are well enough understood to permit optimism in its development and deployment as a space based boost phase interceptor. Mounted on satellites, much as the proposed laser system, the particle beam weapons would be responsible for destroying ICBM's during the boost phase of their flight. Like the laser, the particle beam weapon would depend on a beam of high energy to strike and destroy the target but here the similarities end for the particle beam weapon does not depend on photons or large optically true mirrors to operate. Instead, the particle beam weapon depends on an accelerator and either charged particles, an electron or a proton, or a neutral hydrogen atom for its destructive capability. The accelerator applies a sequential electrical field to the chosen particles until they reach velocities in the nature of 60,000 kilometres per second[15] whereupon they are focussed into a high energy beam. The beam destroys the target because the energy from the particles in the beam is passed on to similar particles in the material of the target thus causing rapid heating to high temperatures and an explosion.

The charged particle and the neutral particle beams are to be used depending on the environment. The neutral particle beam is to be used in space and the charged particle beam is to be used within the atmosphere because in space, the charged particle beam would be susceptible to bending by the earth's magnetic field and divergence of the beam due to repulsion of the like charged particles. The different environments constitute different requirements for capabilities and different limitations and problems for the respective beam weapons.

The exoatmospheric neutral particle beam weapon would be required to create a high powered, precise beam that would diverge or spread minimally at ranges of thousands of kilometres. The main problems associated with this demand can be traced to the accelerator and the power supply. The accelerator controls the velocity and most importantly, the size of the beam as it exits the weapon. Present technology has not yet reduced the size of the beam enough so that it does not diverge beyond an acceptable limit at ranges over a thousand kilometres, which are the most optimal. The second major problem lies in the power supply of the neutral particle beam. As with the high energy laser, the ability to provide a power source small enough to be lifted into space economically and strong enough to power multiple bursts, is still lacking.

The endoatmospheric charged particle beam weapon also suffers from power supply problems. To operate effectively, a charged particle beam weapon requires tremendous amounts of electrical energy over short periods of time. The parameters have been theoretically calculated which a weapon must meet for a beam to propagate through the air, but to the present date they have not been practically met. Unless this problem is countered, any charged beam propagated in the atmosphere will tend to diverge and blow itself apart due to the mutually repulsive forces of the charged particles.[16] Once the parameters are met for both types of particle beam weapons, a very effective weapon will be present upon which to build a strategic defence system that will be deadly in an ASAT and ABM role.

As is evident from the above discussion, strategic defensive systems have developed dramatically in the past two decades but it is also equally evident that much more research and development will be required before a system based on these technologies can be utilised in space. The problems and limitations of the systems are known and are being worked on. Multi-sensored satellites are being developed to differentiate between chaffe, decoys and the real RV's for midcourse and terminal interception. Methods of hardening satellites are being considered and funding for DEW is being increased at unprecedented rates.[17] Changes are occurring and present technology is continuously being updated and surpassed with new data. In twentyfive years time, if the current rate of advancement is continued, it is not unlikely that there will be a strategic defence system in place to protect at least one of the two superpowers.

The form a strategic defence system would take is open to much conjecture, but the prevailing opinion is that it would be in a multi-tiered form regardless of who set it up. It does not take a genius to realise that a multi-tiered defence, a concept of defence in depth, would be much more effective than a single line defence which once breached would be useless and more than likely a hindrance. A defence in depth would provide sequential systems of varying capabilities through which an attack would have to pass, thus making it difficult for the offence to provide all of its systems with enough countermeasures to survive. A single line of defence could be countered by one method but if another line of defence based on another weapon system was added, there is no guarantee the same countermeasure would work again. For every line of defence added, fewer and fewer offensive weapon systems will survive to reach their targets. To increase the uncertainty even further there is no way of knowing which offensive systems will survive and therefore no way of knowing which targets will survive or which will be destroyed.

The optimal strategic defensive system would be tiered to correspond with the different phases in the flight path of an ICBM, the major offensive system to be countered. The first tier of defence would depend on weapons that would strike the ICBM at its most vulnerable stage, during the boost and post boost phase.

The second tier would depend on weapons and sensor systems to strike the RV's among the clutter of decoys in the midcourse phase and the final tier would depend on weapons to strike the RV's in the atmosphere in their terminal phase. Each tier would face different problems and countermeasures and each tier would work under different limitations. No single tier would be expected to destroy 100 percent of the targets it faces but optimally, would rather be expected to destroy a high percentage such that the cumulative effect of all the tiers would reduce the original onslaught to less than one percent actually getting through to strike their targets.[18]

The first tier would consist of prepositioned high energy lasers, neutral particle beam weapons, GBMD systems, and hypervelocity guns in space. These systems are best for the first tier because of their high velocities, especially the DEW systems, which because they operate at or near the speed of light, do not have to lead a target and they can engage multiple targets quickly. This is important as the boost and post boost phase will only last about 100 to 150 seconds. The interplay of the four types of technology should ensure adequate coverage of countermeasures attempted by the offence in a worst case scenario of 1400 ICBM's being launched at once. The more ICBM's destroyed in these phases, the better because once past the post boost phase, the number of targets increase dramatically for the defensive systems as the RV's, decoys, chaffe and electronic penetration aids leave the ICBM buses. If they can be destroyed before the dispersal, the second and third tier stand less chance of being flooded beyond their capabilities.

The second tier of defence would consist of those weapon platforms still effective from the first tier, the LMI and the HIT vehicle tied into a multi-sensored array which would be able to discern the real RV's from the decoys. Speed is not as important for this defence tier as the midcourse phase lasts up to 1500 seconds. Accuracy and the ability to strike the real RV's is of prime importance in this phase.

The last tier would be responsible for the defence from ground zero to where the RV's enter the atmosphere. As far as discerning decoy from RV, the third tier's task is simplified as the decoys and chaffe would be slowed to a greater extent than the real RV's by the atmosphere. Time is again an important element to the defence because the terminal phase is even shorter than the boost and post boost phases and to further complicate the matter, heat hardened RV's are durable objects not easily destroyed. To counter these problems, the third tier would consist of ground based charged particle beam weapons and high altitude interceptors along the lines of the HIT vehicle. These two systems would act as the first line of defence to be supported by low altitude defence systems (LOAD) and point defence systems around primary targets. The latter two systems would rely on high speed missiles launched to explode near the approximate position of an RV and a swarm of homing projectiles which ram an approaching RV respectively.

Without doubt a number of RV's would survive the defensive system to strike their targets, as no defensive system is perfect, but the possibility still exists that a large percentage of the nuclear warheads launched would be destroyed before striking the U.S. or the U.S.S.R. Present technology is not capable of producing the hypothesised defence system. If the present trends in advancement are adequately funded, as the SDI seems to suggest they will be, then the probability of a multi-tiered defence system being deployed is large. Economically, it will be an expensive task costing in the hundreds of billions of dollars over the next two decades, but for reasons to be discussed in the next chapter, the governments of the superpowers seem to be willing to spend the money.

Notes

1. J. Davidson, "BMD: Star wars in perspective," Aerospace America, (January 1984), p. 82.

2. An ICBM goes through four phases from launch to target strike. The first phase is the boost phase (2-5 minutes), the second is the post boost phase (2-10 minutes), the third is the midcourse phase (30 minutes) and the fourth is the terminal phase (½-2 minutes) which starts when the RV enters the atmosphere. The SLBM and the IRBM have the same phases only the post boost and the midcourse would be of shorter duration. For reference see: C.A. Robinson Jr., "Panel Urges Boost-Phase Intercepts," Aviation Week & Space Technology, 119(05 Dec 83),p. 55, and H. Bethe, et al., "Space -based Ballistic-Missile Defense," Scientific American, 251(Oct 84), p. 40.

3. Bethe, p. 47.

4. T. Velocci, "Star Wars Weaponry," International Combat Arms, (Jan 85), p. 90.

5. D.O. Graham, High Frontier A New National Strategy, (Washington: Heritage Foundation, 1982), pp. 119-128.

6. EMP is caused by a nuclear explosion in the atmosphere. Its exact nature is not known but general concensus is that a nuclear explosion would "cause ionization in the atmosphere because of the downcoming gamma rays, but in addition there is a volume of sudden and intense ionization around the burst itself, constituting a highly conductive region that violently displaces the normal lines of force of the earth's magnetic field.... Indeed, a nuclear burst at a 500 kilometer height is estimated to be capable of causing a transient field of 50 thousand volts per meter over the whole of the U.S. mainland." Quoted from R.V. Jones, Future Conflict and New Technology, (Beverly Hills: Sage Publications, 1981), p. 72.

7. A.M. Cunningham, M. Fitzpatrick, Future Fire, (New York: Warner Books, Inc., 1983), p. 98.

8. M. Sheehan, The Arms Race, (Oxford: Martin, Robertson & Company, Ltd., 1983), pp. 94-100.

9. Satellites can follow four general orbits: polar (a low circular orbit between 150 and 2000 km.), geosynchronous (circles the earth at 36ooo km.), elliptical (low of several hundred kilometres to a high of 40000 km at the apogee), and

semisynchronous (a circular orbit at about 20000 km.). R.L. Garwin, et al., "Antisatellite Weapons," Scientific American, 250(Jun 84), p. 48.

10. Robinson Jr., p. 64.

11. B. Beckett, Weapons of Tomorrow, (London: Orbis Publishing, 1982), p. 93.

12. K. Tsipis, "Laser Weapons," Scientific American, 245 (Dec 81), p. 54.

13. Beckett, p. 86.

14. For more information on weapon effects see: Bethe, pp.43-49, Velocci, pp. 92-94 and B. Jasani, "Space: Battlefield of the Future," Futures, 14(Oct 82), pp. 40-43.

15. E. Ulsamer, "The Battle for SDI," Airforce, 68(Feb 85), p. 52.

16. A good summation of the characteristics and problems in particle beam development is R.M. Roberds, "Introducing the Particle Beam Weapon," Air University Review, 37(May 84), pp. 75-84.

17. A Defensive Technologies Study Team has suggested a fiscally constrained development plan for DoD which would see the following monies being spent. ($ million)

	1985	1986	1987	1988	1989
Chemical Lasers	65	90	90	90	90
Excimer Lasers	55	90	90	90	90
Free Electron Lasers	45	75	80	90	90
Neutral Particle Beam	35	50	90	100	100
X-ray Laser	120	150	175	175	175
Other DEW	65	100	125	125	125

Washington, "Defensive Technologies Study Sets Funding Profile Options," Aviation Week & Space Technology, 119(24 Oct 83), p. 51.

18. These figures are totally arbitrary but seem to be the optimal figures based on each tier destroying 90 % of all its targets and letting 10 % through. For example a three tier defence would let just .1 % of all RV's through to reach their targets.

CHAPTER III

Strategic Theory - Implications

The American government, if it accepts Reagan's SDI, will spend in the neighbourhood of $26 billion by 1990 [1] just to research the pertinent technologies involved in a BMD system and estimates for complete deployment range from $100 to $200 billion [2] by the beginning of the twenty first century. American sources also claim that the U.S.S.R. will be spending the same amount if not more for exactly the same purposes. [3] For a tentative goal based on weapon systems not yet invented, the U.S. and the U.S.S.R. are investing a large amount of time, money and manpower. The reason for the gross expenditure on new weapons can be linked to a security dilemma in which the superpowers are entwined and which affects every aspect of their relationship with each other. It is a dilemma which is fuelled by a pervading mistrust of the other's motives and in turn affects arms control talks, drives the technological weapons race and supplies continuous major implications for strategic theory.

The security dilemma which affects the superpowers is not unique to their relationship but is common to most international relationships which involve a security element. The past is rife with examples of security dilemmas from Metternich's balance of power policy for Austria to Chamberlain's policy of appeasement towards Hitler. The main actors caught in the dilemma will change with the passing of time and the surgence of new global powers, but certain factors remain constant within the security dilemma. The U.S. and the U.S.S.R. may believe that their relationship is completely different from all past examples by the scope of involvement and by the nature of strategic weapons, but in reality they are subject to the same factors which have shaped the security policies of past great powers.

The security dilemma mainly revolves around the fact that the actions of one state are not always perceived in the same light by other states in the global system. What may be meant as a purely peaceful move to appease internal domestic elements or attempt to maintain the status quo, may be perceived by other states as offensive, hostile policies guaranteed to ensure superiority or change the status quo in favour of the other instigating state. As Jervis states "many of the means by which a state tries to increase its security decrease the security of others." [4] He aptly demonstrates through the use of the Stag Hunt and Prisoner's Dilemma paradigms, [5] the difficulties facing two actors attempting to cooperate for the mutual benefit of both while at the same time striving to ensure unilaterally one's own security to the detriment of the other. It then becomes a problem over time of each state fearing exploitation by the other if it does cooperate and subsequently compromises its security. The level of fear is a factor of how much a state values its security and whether a state "is predisposed to see either a specific other state as an adversary, or others in general as a menace." [6] If a state puts a high degree of importance on its security and if it sees it is in an ongoing conflictive relationship, it is more likely to stress armaments buildup and be sensitive to changes in the other state's security structure.

These factors are especially pertinent to the U.S. - U.S.S.R. relationship, as both superpowers place a great deal of value on their security and both states see the other as ideological and security adversaries. Any changes in one's military policy has repercussions, as the other tends to misperceive all actions as threats to its security or as attempts to change the strategic balance in favour of the other state. Unfortunately, the situation is further exacerbated by the fact that occasionally each state actually does try to gain superiority or change the balance in its favour, thus leaving the other state to attempt to determine which actions are a real threat and which actions are not. As each sees its very survival in jeopardy, its responses will tend to be conservative in nature and will be negatively influenced towards the other. Thus the two superpowers will compete rather than cooperate on security issues, as is clearly evident from the relationship between the U.S. and the U.S.S.R.

since the end of WWII, when they assumed positions of predominance in the international arena.

The competitive relationship, actuated by the factors of the security dilemma, is further fuelled by the basic distrust of each other's motives also so evident in the security dilemma. Through ignorance of the other's society and culture and because of the polemic ideological exchanges so endemic to the superpower relationship, neither side can bring itself to fully trust the other. In conjunction with and as part of the security dilemma, the distrust of each other's motives leads toward emphasising the aggressiveness in the other and the peaceful intent of their own policies. This can be shown by examples garnered from official sources of both the U.S. and the U.S.S.R.

The U.S. Defense Intelligence Agency concluded that Soviet Military Space Doctrine is such that "the Soviet Armed Forces shall be provided with all resources necessary to maintain military superiority in outer space sufficient both to deny the use of outer space to other states and to assure maximum space-based military support for Soviet offensive and defensive combat operations on land, at sea, in air and in outer space."[7] In contrast, the U.S. space doctrine is that they "of course, have no weapons in space and no current development program for weapons in space, but they are nonetheless, obligated to be prepared to respond to any Soviet challenge."[8] Similarly, "to prevent the militarization of outer space is an integral part of the peaceful foreign policy consistently and constructively advocated by the U.S.S.R. However, the U.S. position impedes progress in the field" [9] and "the Soviet Union has invariably stood for peace in outer space." [10] Consistent with the above, Kremlin spokesman Leonid Zamyatin responds with the following to the American SDI. "Does the United States think the Soviet Union will sit idle, awaiting the results of the U.S. 'research'? Faced with such dangerous plans, the Soviet Union will do all in its power to prevent the U.S. superiority over itself." [11]

Obviously in an atmosphere of damning rhetoric, it is difficult to trust the other and when cooperation is attempted, it is continuously subject to misperceptions and half truths. Regardless of the statements made by one or the other superpower, actions will be interpreted almost solely in light of the security dilemma and the concurrent distrust. This factor is convincingly exemplified in the failure of arms control talks and agreements between the U.S. and the U.S.S.R.

Due to the inability of one state to trust the other's motives and the misperceptions each state has of the other, successful arms control is not possible. Any propositions advanced by the U.S. or the U.S.S.R. will be perceived as advantageous to the proposer and therefore disadvantageous to the recipient. Compromise, which is at the core of arms control, is not probable in a win-lose environment." Few fields of human endeavour display as great a gap between what is hoped for and what has been realised as strategic arms control." 12 Agreements have been made, treaties have been signed, yet the overall effect has been such that the U.S. has doubled and the U.S.S.R. has quadrupled their strategic capabilities since the first arms agreement. No matter how it is defined, this is not success. There has not been effective control of any of the strategic weapons and arms control has only managed to redirect research and development into other types of weapon systems. Limits on launchers only led to the deployment of MIRV's and the development of cruise missile technology. The ABM Treaty which was highly touted as an example of an effective agreement, did not prohibit the research into future defence systems, thus sowing the seeds of its own demise in the near future, especially if the SDI and the Soviet equivalent are able to defeat successfully the present technological obstacles to a strategic defence system.

The lack of success of arms control is related to the arms control process, the lack of verification and the inability to punish noncompliance of a signed agreement successfully. The main goal of arms control to limit nuclear weapons has become secondary to making political points and propaganda. Governments have used and are using the process of arms control talks as a tactic to gain domestic and alliance approval to further other schemes. For example in NATO, it has become easier for

European governments to accept the stationing of U.S. Pershing II, ground launched cruise missiles, and provide support for the SDI, now that the Reagan administration has renewed arms control talks with the U.S.S.R. In addition, the U.S. and the U.S.S.R. capitalise on the other's distrust by using the arms control venue to propose plans of action that in reality stand little chance of being accepted by the other, thus gaining propaganda points at the expense of the talks. An example of this was the U.S.S.R.'s endeavour to halt ASAT technology at present levels knowing that the U.S. could not accept the proposal as long as the U.S.S.R. had the only ASAT system that had been tested. Caught in the security dilemma, the U.S. could not cooperate as long as the U.S.S.R. had a perceived superiority in a strategic weapon system.

The lack of verification of compliance with an arms control agreement can also be attributed to problems exacerbated by the U.S. and the U.S.S.R.'s mutual distrust. Politically, neither superpower could or would accept a policy of 100 percent open site verification of their strategic weapon systems. Thus each is left up to their own technical means, usually satellites and planes, to determine if the other is complying in full with arms control agreements. Unfortunately even the latest class of spy satellite is unable to see through all of the walls and roofs surrounding the strategic weapons and if they do detect an object or action that rates as noncompliance, there is no substantial method of punishment. The U.S. or the U.S.S.R. can rant and rave and provide proof of noncompliance but these actions have been observed to be of little value in actually addressing the problem. As each superpower has come to expect polemical displays from the other, their punishment value for noncompliance in terms of security ramifications is minimal for the defaulting state.

It is apparent that the common theme throughout the discussion on arms control again relates back to the security dilemma and the distrust each superpower has for the other. Arms control talks will continue to be of extremely limited effectiveness as long as the U.S. and the U.S.S.R. are caught in the dilemma and remain unwilling to cooperate for fear of a disparity in the strategic balance caused by an unanticipated technological breakthrough. As outlined earlier in the ABM Treaty, neither side is willing to prohibit or control the research of new weapon systems which may give them the advantage in the distant or not too distant future. Consequently, the security dilemma fuels the technological development of more and 'better' weapons and the distrust factor ensures a trend of willingness to develop one's own weapons rather than depending on other means for security.

Historically, the development of military technology has often been subject to a cycle propagated by a security dilemma between two or more military powers. In response to the development of a new weapon, adversaries would attempt to counter it by a change in tactics or by developing another weapon technology either to shield one from the new weapon or reduce the original to obsolescence or ineffectualness. The cycle would continue as it became necessary to develop new technologies in response to the counter weapons and so on, until the situation now arises of cycles completing a full turn in less than a generation.

In the past, the style of warfare and the lack of industrialisation generally guaranteed a gradual evolution of the cycle. Weapon changes were often measured in centuries and therefore would be moderated by time. For example, when the sword and spear were the dominant weapons, a walled city was a formidable redoubt for even the most determined of foes. Usually the only method available to capture such a city was to lay siege or utilise deceit as in the case of the Trojan Horse. Centuries would pass until the invention of gunpowder and cannon would combine to hurl iron balls at the walls of the forts and cities. But even then change was slow as the first cannons were often huge and inaccurate and slow to use. Response to the cannon was to thicken walls with stouter materials and shape them to deflect the cannon balls. Eventually though, cannons developed to the extent that even the walls of Constantinople fell to the Turkish artillery in 1453 in forty days.

> But the answer was quickly found. Fire could only be countered by fire. At first the defenders improvised. They installed their own guns to fire through ports in the curtain walls, to keep the attack at a distance. They built and manned earthworks...then they began to abandon the vulnerable advantage of visibility for the more practical one of defence in depth. 13

Change would bring change until WWII, whereupon the concept of strategic bombing advanced to the fore as the most effectual method of destroying cities. In a matter of twenty-five years, from WWI to WWII, the concept had developed whereby large formations of heavy bombers would drop tons of bombs on cities in the hope of destroying them and their industrial capacity. It was not done without a heavy cost from enemy fighters and anti-aircraft batteries, but the costs became more acceptable with the development of the nuclear weapons technology in 1945 which provided the Allies with the capacity to destroy a city with one bomb.

The epitome of an offensive strategic weapon was not realised until the development of the ICBM in the late 1950's. The advent of the ICBM gave the U.S. and the U.S.S.R. the capability to destroy the other's society. There was no adequate defence available or foreseen which would negate the destructiveness of nuclear weapons; that is not until 1983 when U.S. President Ronald Reagan announced his Strategic Defense Initiative. The cycle turns and in less than thirty years the ICBM could become the victim of advances in weapons technology.

The technological cycle, as fuelled by the security dilemma, could also be included as a key factor in the dilemma because the cycle tends to feed upon itself to instigate a self perpetuating motion. One change in weapons technology drives adversaries to find a technical solution for the problems inherent in the change, rather than relying on a non-technical solution subject to distrust and the whims and peccadilloes of politics. This has become more so the case in the twentieth century with the rapid industrialisation of the Northern hemisphere. Technological change and development have become accepted in all aspects of society such that the tendency for technical solutions is further reinforced in decision makers. The trend is particularly noticeable in the development of strategic weapon systems.

After the first series of Sputnik launches by the U.S.S.R. in the late 1950's, the American administration came to the conclusion that the U.S.S.R. would rapidly develop its ICBM force to the limits of its capabilities. The Americans perceived a missile gap in which they were technologically inferior to the Soviets. [14] The solution was a rapid and massive ICBM research and development program, which produced a total of 284 American ICBM's to the Soviet's 35 (See Tables I and II) by 1963. A quick technological fix was repeated by both superpowers until they now have enough missiles to destroy each other a number of times. But quantity is not the only response available to the U.S. and the U.S.S.R. As ICBM's became more accurate, targets were hardened forcing more stringent requirements for accuracy than before. Missile launchers were limited by the SALT I Agreement but this was circumvented by MIRVing and the development of different types of delivery systems; the cruise missile family. To detect and destroy the cruise missiles, look down - shoot down systems were developed only to be outpaced by the development of supersonic, stealth cruise missiles. In response to the offensive strategic weapons, the U.S. and the U.S.S.R. are now researching defensive systems as a technological solution to the present nuclear arms competition. This point is further emphasised by President Reagan's SDI which he states "is a program of vigorous research focussed on advanced defensive technologies with the aim of finding ways to provide a better basis for deterring aggression, strengthening stability, and increasing the security of the United States and our allies." [15]

The technological factor is not just a means to an end, it also influences the parameters and direction that strategy will take. The question is often raised whether the technology came first and strategy was in response to what weapons were developed or was defined or redefined by the systems available. In contrast, was strategy formulated first and were the weapons developed to fit the strategy? Unfortunately attempting to answer these questions is reminiscent of determining whether the chicken or the egg came first. What is obvious is that technology does affect formulation of strategy in various ways.

The possible change from the present offensive nuclear strategy to space based defencive strategy exemplifies different ways by which technological factors can influence strategy. The idea of basing defensive weapons in space is related to two issues. The first is in reference to the multi-tiered defence system discussed in the previous chapter and the second is related to the growing importance of passive weapon systems already in space. As described earlier, the most important defence tier is the first one which is utilised in the boost and post boost phase. If the ICBM's can be destroyed in these phases before they can deploy all of their warheads and decoys, the task becomes much simpler for the remaining defence tiers. Consequently, as the weapons with the most promise to accomplish the task effectively, DEW's and hypervelocity guns depend on being satellite mounted for best results, thus focussing strategy on the space environment.

The second issue is tied to the growing realisation by the two superpowers of the importance of present space based systems that enhance their military capabilities. In the past, there has been a tendency to neglect satellites in space that serve a military function, possibly because of their passive nature, which will contrast starkly with the active nature of the proposed ABM and ASAT space weapons. Both the U.S. and the

U.S.S.R. depend on a number of satellites to carry out various military missions that are best accomplished from space. The U.S. is considered to be more dependent, as its forces tend to be spread all over the globe, whereas the U.S.S.R.'s forces are generally situated in the U.S.S.R. giving it the advantage of internal lines of communication. This is actually less the case than before, as the U.S.S.R. has expanded its bluewater and SSBN fleet since the mid 1960's to the point that they are just as far flung as the U.S. and also must rely heavily on navigation, communication and reconnaissance satellites.

Regardless, the U.S. and the U.S.S.R. rely on a system of reconnaissance, ocean surveillance, early warning, nuclear explosion detection, communications, navigation, meteorological and geodetic satellites [16] to assist their conventional and nuclear forces and verify the activities of the other. It has progressed to such an extent that without their respective satellite systems, the military forces of the U.S. and the U.S.S.R. would be blind, deaf, dumb and lost in time of a strategic conflict. Both sides have a lot to lose if their satellite systems are destroyed and therefore are very much interested in protecting their space based assets and destroying the others' with as many technological means as possible. As the proposed space based ABM weapon systems could perform as effective ASAT weapons or as effective satellite defence systems better than an earth based system could, technological emphasis is once again placed on the space environment.

Technology also plays a role in the advent of a predominantly defence oriented strategy as compared to an offensive strategy by providing impetus towards the defence. When the ABM Treaty was signed in 1972, technology was not capable of providing impetus towards the defence. When the ABM Treaty was signed in 1972, technology was not capable of providing a defence against strategic nuclear weapons thus the concept of an offensive strategy was reinforced among policy makers. However defence research was going on and as outlined in the previous chapter had advanced enough to warrant serious consideration by the U.S. and the U.S.S.R. of the future possibility of a strategic defence system. To make the strategic defence viable, scientists will not only have to develop the appropriate defensive weapon systems but also do it such that the defensive technology is economically cheaper than the offensive weapon systems they are to counter. If the technology becomes too expensive or non-effective, the new defensive strategy will be subordinated by the present offensive nuclear strategy.

Technology is not the only factor involved in strategy formulation but it is a major one which has to be considered in light of the U.S. - U.S.S.R. security dilemma and the tendency to resolve strategic problems with technical solutions. Technology and the security dilemma are two closely interwoven issues that will continue to bring strategic changes. The changes will have repercussions on the present nuclear strategy in the years to come, but contrary to nuclear weapons and the strategy which followed their development, present decision makers will have time to consider the implications of a major strategic shift to the defence. It will be years before all of the technological problems are surmounted for a space based defence system, at least twenty years by my guess, so it is imperative that the full implications on the present nuclear strategy of a defensive shift be analysed. With a thorough analysis, decisions can be justified or changed so that a viable strategy will be prepared for the eventual deployment of the space based weapon systems.

Present nuclear strategy is founded on the doctrine of deterrence. It is not a new concept but one which has been practiced in one form or another since Thucydides, recounted in his Peloponnesian War "instances where one side or another manoeuvered for allies or other advantages in such a way that its opponent would think that beginning a war, or expanding it, would not be worth the risks or costs." [17] In the eighteenth and nineteenth century European balance of power systems, the fundamental principle "was that the military capabilities available to any combination of powers should be sufficiently balanced so that full scale conflict would appear profitless." [18] The system collapsed with the beginning of WWI in 1914 and from hen until the mid 1940's, the concept was relegated to historical analysis. In the late 1940's, Bernard Brodie and Jacob Viner [19] realised the consequences for strategy of the atomic bomb and the concept was rediscovered to adopt a prominent position as the basis for present nuclear strategy.

Deterrence has been analysed by many scholars and strategists and a general consensus of its definition can be achieved by comparing their different works. Richard Smoke and Alexander George see deterrence in its most general form as "simply the persuasion of one's opponent that the costs and/or the risks of a given course of action he might take outweigh its benefits." [20] Dr. Henry Kissinger defined deterrence "as being the ability to prevent certain threats or actions from being carried out by posing an equivalent or greater threat." [21] Baylis, Booth, Garnett and Williams are more specific in that "deterrence can be seen as a particular type of social or political relationship in which one party tries to influence the behaviour of another in desired directions...or it is basically an attempt by party A to prevent party B from undertaking a course of action which A regards as undesirable, by threatening to inflict unacceptable costs upon B in the event that the action is taken." [22] There is a commonality among the definitions presented for deterrence, but actually transposing the concept into a realistic nuclear strategy has proven to be a difficult task for decision makers.

The formulation of a practical nuclear strategy based on deterrence has been an evolutionary process subject to the aforementioned security dilemma and technological development of nuclear weapons. From the first use of atom bombs in 1945 until a speech to the Council on Foreign Relations by Secretary of State John Foster Dulles in 1954, nuclear strategies underwent fluctuating credibility in the eyes of the Truman administration with no single coherent policy being identified. This trend ceased with the adoption of the massive retaliation strategy as outlined in NSC - 162/2 in 1953 and further 'clarified' by Dulles in 1954. [23] Massive retaliation was a trip-wire strategy assumed to be "founded on an undiscriminating threat to respond to any communist-inspired aggression, however marginal the confrontation, by means of a massive nuclear strike against the centres of the Soviet Union and China." [24] The strategy was appropriate as long as the U.S. was in a position of massive nuclear superiority and there was the political will to carry it out. By the early 1960's, however, the U.S. was still superior but the Soviets were perceived to have a deterrent capability and in the U.S. there was no longer any evidence of the necessary political will to utilise the strategy. In response to the criticisms [25] and apparent weaknesses, the Kennedy administration adopted the strategy of mutual assured destruction which is still the present basic nuclear strategy.

Mutual assured destruction or MAD, as it is commonly known, relies on the concept of mutual deterrence for its efficacy. Each state threatens the destruction of the other's society by means of nuclear weapons. Enthoven and Smith define assured destruction from the U.S. perspective as the ability to "deter a deliberate nuclear attack on the United States or its allies by maintaining at all times a clear and unmistakable ability to inflict an unacceptable degree of damage upon any aggressor, or combination of aggressors - even after absorbing a surprise first strike." [26] The mutual aspect of MAD recognises the ability of the U.S.S.R. to adopt the same nuclear policy and inflict unacceptable damage upon the U.S. even after a surprise first strike.

In terms more specific and more familiar to strategists, MAD can be defined such that the U.S. and the U.S.S.R. retain a secure second strike capability to be used in a counter-value attack if either is subject to a first strike counter-force attack from the other. The terminology may seem confusing but in reality sums up MAD succintly if the strategic jargon is understood. A first strike means that a power has the ability to launch attack on an opponent without prior warning. The attack maximises surprise and is supposed to devastate the opponent's ability to respond in kind. A secure second strike capability means that an adversary, who has been a victim of a first strike attack, has the ability to absorb the first strike and retaliate with enough nuclear weapons to inflict unacceptable damage upon the launcher of the first strike. Counter-value attacks are against enemy cities whereas counter-force attacks are against an enemy's military and nuclear retaliatory forces.

Of the strategic triad described in the introductory chapter, the ICBM is considered the optimal first strike counter-force weapon because of its accuracy, throw weight, and vulnerability to enemy missiles. Because it is fired from a known fixed position, it is easier to calculate its ballistic path to an acceptable target than for a SLBM and because ICBM's are not limited in size, as the SLBM is, they can carry more and larger warheads to strike protected targets. The fixed nature of the ICBM's and the fact that the U.S. and the U.S.S.R. can determine where their silos are, makes them vulnerable to enemy ICBM's. Therefore to ensure that they are not destroyed in their silos, it is more efficient to use them in a first strike role.

Since it is more efficient to use ICBM's in the first strike role, their continued development and deployment serve to heighten the security dilemma. No matter how often one power states that it is deploying ICBM's as a defencive measure, the other power will perceive the ICBM's, because of their vulnerability, as purely first strike weapons and conclude that the other is lying. Distrust of each other would increase and deterrence would be weakened as the misperceptions of the other power building an effective first strike force continued. Pressure for an alternative strategy for deterrence would mount as a means was sought to counter an ICBM first strike force. The SLBM and long range bombers are better suited for the second strike counter-value role because of the SLBM's invulnerability and poorer accuracy and the bomber's inability to reach targets quickly. Anti-submarine warfare (ASW) has not advanced to the stage where it can ensure detection of all of an opponent's submarines. The SSBN's are therefore relatively secure from destruction in a first strike attack as there is no way of knowing where they are in the oceans. It is also difficult for the SSBN's to determine exactly their own precise launch location. Plus they are not stable launch platforms, thus not as accurate as the ICBM, serving instead as viable weapons for large area targets, such as cities. The long range bomber, even with the addition of the ALCM and SRAM, are extremely slow to reach their targets, thus providing plenty of advance warning of their intentions and are vulnerable to anti-aircraft defences. The two factors combined make them appropriate follow on second strike weapons rather than first strike counter-force weapons.

The MAD strategy has withstood the ravages of time and academics but not without the realisation that there are problems endemic to the doctrine. Hans Morgenthau identified four paradoxes in nuclear strategy. Considered in conjunction with the psychological factor in deterrence, they will continue to pose difficulties for decision makers because of the prevalent security dilemma and the technological influence of changing nuclear weapon systems.

Morgenthau listed the four paradoxes as:

> the commitment to the use of force, nuclear or otherwise, paralyzed by the fear of having to use it; the search for a nuclear strategy which would avoid the predictable consequences of nuclear war; the pursuit of a nuclear armaments race joined with attempts to stop it; the pursuit of an alliance policy which the availability of nuclear weapons has rendered obsolete. 27

The first paradox relates to the fact that the U.S. and the U.S.S.R. have built up large conventional and nuclear military forces and have often threatened to use them against the other under certain conditions or criteria but in general have refrained from using military force against each other for fear of escalation to a nuclear exchange. Both states realise the implications of engaging in nuclear war and so do the utmost to keep from coming into conflict with each other over any issue in case neither side could stop the escalation of conventional warfare into nuclear warfare. Conversely both continue to arm themselves with newer and better weapons just in case they are required. Therefore the U.S. and the U.S.S.R. are becoming more powerful and yet increasingly apprehensive about utilising their forces.

The second paradox refers to "the desire to reconcile the use of nuclear weapons with the admitted irrationality of all out nuclear war and the attempt, inspired by this desire, to discover a rational way to use them. Thus we have been in search of a method of waging nuclear war in the conventional manner so that nuclear war may produce conventional, that is, rational and tolerable consequences." [28]

The third paradox recognises that the impetus of the technological drive on nuclear weapons development, which was discussed earlier, is irrational and therefore attempts should be made to stop or limit it while maintaining an adequate deterrent force. The problems in this paradox are that there is distrust of motives negating the arms control talks and there is difficulty in deciding what is adequate for the U.S. and the U.S.S.R. to ensure deterrence.

The final paradox in nuclear strategy is that conventional alliances pose a large number of problems for the nuclear capabilities of the U.S. and the U.S.S.R. When MAD is extended to include respective allies, difficulties arise for "either the alliance cannot be relied upon when the chips are down, or it gives one member power over the life and death of another member," [29] or it can draw the U.S. and the U.S.S.R. into a direct confrontation, which neither wants. An ally may become embroiled in a war with an ally of the other superpower and either because it starts to lose or win too decisively, one of the superpowers is drawn into the fray to be shortly followed by the other. Much to the consternation of the U.S. and the U.S.S.R., they would be drawn into a conventional, limited war which could escalate into a nuclear exchange. In summation, the paradoxes reveal that attempting to function in a nuclear world, utilising conventional strategies and policies as the U.S. and the U.S.S.R. have been, will only lead to a continuation of the present security dilemma.

In addition to the paradoxes discussed above, there is a psychological factor implicit to deterrence. Deterrence depends on a threat which J.D. Singer defines as "the product of the estimated capability of the opponent's forces multiplied by the estimated probability that he will use them." [30] Therefore besides having the physical capability to carry out a threat there must also be a subjective perception of the will to carry the threat to its conclusion. The subjective perception is a psychological factor which depends "upon the perception and the evaluation that go on in the mind of the potential aggressor." [31] The problem for deterrence theory is that perceptions of other's actions and words are not consistent between two opponents.

A society's perceptions are based on its history, culture, languages, religions and ideologies and as the U.S. and the U.S.S.R. have developed differently in all of these categories, it is unrealistic to assume they will perceive actions in the same light. It is not possible for one of the two states to assume it knows how the other thinks. American perceptions will not be the same as Soviet perceptions thus leading to increased chances of misinterpreting the other's actions. This factor adversely affects deterrence because the nuclear capabilities of the U.S. and the U.S.S.R. are often perceived differently depending on the observer. A weapons role, whether it is first strike or second strike, is misperceived and only too frequently, the weapon's abilities are exaggerated or deemphasised to gain concessions or confuse the opposition. Whether or not the weapon is actually first or second strike is of relatively little importance as long as the two superpowers disagree as to its perceived capabilities.

A recent example is the development of the American cruise missile and its deployment in Europe. The Americans contend, because of its slow subsonic speed, the cruise missile is a second strike weapon in response to the Soviet SS-20 IRBM. The Soviets, on the other hand contend, because it is so small, easily concealed against observation and difficult to defend against, it is a first strike weapon that upsets the deterrence. In reality, it upsets deterrence because of the opposing contentions over its use.

Perceptions are also relevant when they concern the will to engage in a nuclear exchange. The threat inherent to deterrence must be supported by certainty among decision makers as to the likelihood of the threat being carried out. If there is certainty that the threat will not be carried out, that there will be no apparent intention to use force, then one of the basic elements of deterrence would be missing and the strategy would not be viable. In the J.D. Singer quote, the threat was defined as a product of two factors and in mathematics, if one factor is zero then the whole equation equals zero. If there is no threat then there is no deterrence. On the other hand, if there is uncertainty as to whether or not there is the will to carry out the threat, then there will be deterrence as neither power would be willing to gamble on a nuclear exchange and suffer in the consequences of being wrong. There are limits to the degree of uncertainty permissible in the deterrence relationship. Too much uncertainty increases the amount of emotional stress placed upon the decision makers for as Charles Osgood noted "as emotional stress increases beyond an optimal level, non-rational mechanisms become more prevalent in human thinking and faced with an overwhelming threat over which he feels he has no control, the human individual typically denies the reality of danger rather than keeping it in mind and trying to cope with it." 32 Therefore it is possible that too much uncertainty and stress could lead to eventual denial of the existence of the threat so important to deterrence or at the least a downplaying of its significance.

Despite the problems, misperceptions, and distrust, the U.S. and the U.S.S.R. have managed to refrain from becoming embroiled in a nuclear war for over thirty years. The concept of deterrence, as invoked by MAD, has withstood the vagaries of international politics regardless of its inherent problems and paradoxes. However, the continuance of the present situation is not assured. A combination of the security dilemma, the technological drive and the distrust of the other's motives constantly pressures individuals to attempt to find new solutions, new strategies which do not contain the paradoxes that MAD does. The present emphasis on defence as a viable strategy is an example of a strategy that will have implications for deterrence and MAD.

Defence as a strategy has had as long a history of fluctuating importance as deterrence. Unlike deterrence, defence does not rely on a psychological factor but rather "entails physically blunting the enemy attack and minimising its effect on oneself." [33] Dependence for survival would be placed on a defender's physical capability to destroy an attacker's strategic forces rather than on the threat to destroy the other's society and have one's own society held hostage in a like manner. In the modern context, as envisioned by the SDI, defence would mean the destruction of weapons, not people and societies and a complete dependence upon one's own resources and military capability.

Nuclear deterrence strategy has always suffered from questions about its credibility because of the inherent paradoxes as outlined by Morgenthau. The tensions created in the deterrence strategies by the uncertainty surrounding the will to actually utilise nuclear weapons in any role, knowing their destructive capabilities, added to the factors stimulating the security dilemma, have created the need for alternative strategies. Rather than debate the certainty or uncertainty of use, it would be better to use a strategy which could ignore or negate the problems. The drive for a 'better' strategy, such as defence, has been guaranteed by the increasing lack of credibility of the nuclear deterrence strategy. If a defensive strategy was adopted, deterrence strategy would be affected and practical problems would not cease to exist, as the security dilemma and superpower rivalry is sure to continue.

Notes

1. U.S. Government, The President's Strategic Defense Initiative, (Washington: Government Printing Office, 1985), p. 10.

2. The two figures reflect the current debate over the SDI. Those who are pro-SDI estimate it will only cost about $100 billion while those who are anti-SDI, estimate it will cost as much as $200 billion.

3. U.S. Department of Defense, Soviet Military Power, (Washington: Government Printing Office, 1984), p. 47.

4. R. Jervis, "Cooperation under the Security Dillemma," in R.J. Art, R. Jervis, International Politics, (Boston: Little, Brown and Company, 1985), p. 88.

5. Jervis, pp. 86-101.

6. Jervis, p. 91.

7. U.S. Defense Intelligence Agency, Soviet Military Space Doctrine, (Washington: Defense Intelligence Agency, 1984), p. 32.

8. E.C. Aldridge Jr., "Defense in the Fourth Medium," Defense, (Jan 83), p. 7.

9. A. Piradov, "For Peaceful Uses of Outer Space," International Affairs, 7(Jul 83), p.38.

10. A. Kozyrev, "No Arms Race in Outer Space," International Affairs, 6(Jul 82), p.85.

11. Associated Press, "Soviets vow to match Star Wars," The Globe and Mail, (22 Feb 85), p.8.

12. G.F. Kennan, et al., "The President's Choice: Star Wars or Arms Control," Foreign Affairs, 63(Winter 84/85), p. 266.

13. M. Howard, War in European History, (Oxford: Oxford University Press, 1976), p. 35.

14. Support for the missile gap idea was provided by more than the security dilemma. Domestic pressure was also prevalent as per L. Freedman, The Evolution of Nuclear Strategy, (New York: St. Martin's Press, 1981), pp. 140-144.

15. U.S. Government, p. 1.

16. For a more detailed listing of military satellites see: G.M. Steinberg, "The Militarization of Space," Futures, 14 (Oct 82), pp. 379-383 and B. Jasani, M.A. Lunderius, "Peaceful Uses of Outer Space-Legal Fiction and Military Reality," Bulletin of Peace Proposals, 11(1980), pp. 58-60.

17. A.L. George, R. Smoke, Deterrence in American Foreign Policy: Theory and Practice, (New York: Columbia University Press, 1974), p. 12.

18. A.L. George, p. 14.

19. T. Draper, "Nuclear Temptation," New York Review, (19 Jan 84), p. 42.

20. A.L. George, p. 11.

21. M. Sheehan, The Arms Race, (Oxford: Martin Robertson & Company, Ltd., 1983), p.4.

22. J. Baylis, et al., Contemporary Strategy, (New York: Holmes & Meier Publishers, Inc., 1975), p. 69.

23. Freedman, pp. 76-84.

24. Freedman, p. 76.

25. Freedman, pp. 84-90 for a good discussion of criticisms of the massive retaliation strategy.

26. Freedman, p. 246.

27. H.J. Morgenthau, "The Four Paradoxes of Nuclear Strategy," American Political Science Review, 58(Mar 64), p. 23.

28. Morgenthau, p. 25.

29. Morgenthau, p. 35.

30. A. Legault, G. Lindsey, The Dynamics of the Nuclear Balance, (Ithaca: Cornell University Press, 1976), p. 140.

31. J.E. Dougherty, R.L. Pfaltzgraff, Contending Theories of International Relations, (New York: Harper & Row, Publishers, Inc., 1981), p. 375.

32. Dougherty, p. 388.

33. L. Martin, Arms and Strategy, (London: Weidenfield & Nicholson, 1973), p. 13.

CHAPTER IV

Practical Strategic Implications

Introduction

Nuclear deterrence strategy, a symptom of the security dilemma and endemic distrust between the U.S. and the U.S.S.R., is suffering from a lack of credibility. The combination of nuclear paradoxes, technological advances and the problems discussed in the previous chapter have provided the impetus for a new superpower strategy and that is one of defence. Rather than rely on the threat in MAD, the U.S. and the U.S.S.R. will develop the technology to depend on national technical capabilities for survival. It is important at this point to restate the original assumption which is the basis for this thesis so as to ensure the parameters are clear for what is about to follow in this chapter. The original assumption is that policy makers in the U.S. and the U.S.S.R. will continue the historical trend of arms development, will develop the new technologies and will position them into space as strategic defensive systems within twenty years. As stated earlier, there are technological difficulties to surmount before an effective system can be deployed but the impetus is available to ensure that the maximum effort is applied for the successful deployment of a strategic defence system.

When such a system is finally deployed, it will signal the eminence of defence in strategic thinking. The repercussions of the change from deterrence to defence will have far reaching implications on different aspects of the U.S. - U.S.S.R. strategic relationship. The change in strategy and dependence upon a new defence-oriented technology would affect deterrence, in a manner to be discussed, and thus American and Soviet strategic interaction. The arms competition would take a new direction, arms control talks would be subject to new dilemmas and the major alliances such as NORAD and NATO would require restructuring to accomodate the new strategy. Each of these factors will be examined in greater detail but before doing so, certain points require clarification.

It must be remembered that the following material will be somewhat speculative in nature. Based on past trends and present strategic conditions, the analysis will attempt, through the educated application of existing knowledge to a future strategic environment, to address issues which will be of importance to decision makers. The whole purpose of the paper is to generate interest in the topic, whether it is benign or conflictive, for two reasons. Firstly, by analysing the change in strategy before it occurs, decision makers can be made aware of the significance of the shift from offence to defence. Secondly, by being conscious of the problems inherent in the change, decision makers could respond by reducing difficulties in defence strategy formulation. This would be in contrast to nuclear strategy which was formulated after the deployment of nuclear weapon systems. To best achieve this result, analysis will be focussed on the implications of BMD deployment for deterrence, the arms race, arms control, NORAD and NATO. Other areas of study could be chosen but this grouping should be representative of the major issues which will be involved in the shift from an offensive to a defensive strategy.

Deterrence

Defence and deterrence are not completely dissociated from each other. On the contrary, deterrence has always depended on a limited defensive capability especially when considering the MAD strategy. The U.S.S.R., since the 1940's, and the U.S., since the 1950's, have developed continental bomber defence systems to limit the destructive capabilities of the long range bomber. With the introduction of ICBM's and SLBM's into the nuclear arsenal, both have pursued to a limited degree, strategies of damage limitation in conjunction with the defence measures taken as part of MAD. Damage limitation as defined by Secretary McNamara in 1964 was "to limit damage to our population and industrial capacities in the event of war." [1] The U.S.S.R. must have had a similar policy as it too instigated civil and industrial defence programs. Besides these measures, the military were adopting defence measures to ensure the success of deterrence.

As nuclear missiles were developed and deployed, it became obvious that without any defence measures being taken, they were vulnerable to a first strike attack. Their vulnerability was seen as destabilising for deterrence because it was not possible to guarantee a secure second strike capability unless a launch-on-warning (LOW) strategy was adopted. A LOW strategy would entail immediate launching of all vulnerable nuclear weapons upon warning of an opponent's missile launch. Such a strategy would be vulnerable to false warnings, accidental launches and would remove all chances for a political settlement of differences. It was not known if enough missiles would survive a first strike to be able to deliver unacceptable damage upon an opponent. To stabilise the situation, active and passive defence measures were taken to increase the degree of survivability of strategic weapon systems and thus guarantee a secure second strike capability. Active defence measures constituted the development of nuclear armed ABM missiles which depended on exploding near a RV to destroy it or knock it off course. It was not an efficient system because the nuclear explosion caused by the ABM could be damaging to its owner, a fact recognised by the U.S. and the U.S.S.R. when they signed the ABM Treaty in 1972, thus de facto implying that technology was not up to the ABM task at that time.

Passive defence measures, which are ongoing, included the deployment of SLBM's in SSBN's, the hardening of ICBM silos to withstand everything but a direct hit by nuclear missiles in the megaton range, the development of secure C_3I (communication, command, control, intelligence) capabilities through the deployment of satellites, ground based detection systems, and civil defence planning. The combination of active and passive measures guaranteed the survival of a secure second strike force and thus stabilised deterrence. The defence ensured the viability of the threat of assured destruction.

The move towards more active defence systems will have implications for deterrence depending upon the level of defence adopted. If a limited defence system is deployed instead of the proposed multi-tiered system, deterrence will be positively rather than adversely affected.

> First it could significantly increase an aggressor's uncertainties regarding whether his weapons would penetrate the defenses and destroy our missiles and other military targets. Such uncertainties also would serve to reduce or eliminate the incentive for first strike attack. [2]

In addition to the above, an adversary would never be able to know beforehand which missiles survived to strike which targets. Uncertainty would increase as there would be no assurance that the first strike destroyed the optimal targets. Limited defence would therefore increase the survivability of a secure second strike and the uncertainty facing an opponent who has the capability of launching a first strike. Attempts would be made to destroy the defence systems but a preliminary attack upon them would only serve to warn of an impending strike. An attack upon them concurrent with a first strike would still be subject to uncertainty.

The deployment of a complete multi-tiered defence system will not be beneficial for the MAD strategy. The capability to actualise the nuclear threat would no longer be certain for either superpower if both deploy effective systems as is assumed by this paper. An effective BMD system would be able to defend itself from attack and still destroy a large percentage of a nuclear strike launched by an opposing power. A surprise first strike would not be able to reach its target in sufficient numbers to guarantee success, but a second strike response to the first strike would be just as vulnerable to the opposition's BMD. Therefore neither superpower would be able to realistically threaten the other with a barrage of nuclear weapons. MAD, which depends on both states maintaining a secure second strike capability to destroy countervalue targets, would no longer constitute a functional nuclear strategy.

In addition, more problems for nuclear deterrence would arise depending on whether the shift to defensive weapons was a gradual or a swift process for the Americans and the Soviets. If the technical shift is gradual, that is, the defensive weapon systems are deployed one tier at a time or one system at a time over the next twenty years, then the transition will be completed more or less smoothly. The reason for this is that the early deployment stages would actually enhance the security of the threat in MAD and would also permit the two superpowers to maintain a balance of defensive systems and forces. Therefore when the critical stage was reached when one more system or tier would emphasise the defence over deterrence, both powers would be at relatively the same level of deployment and subject to the same problems and insecurities as the other. Mutual uncertainty over the effectiveness of the defensive shields would warrant less conflictive policies and more conservative tendencies until the final stages of defence were deployed. Once the final stages were deployed, as I predict they will be, the U.S. and the U.S.S.R. will be faced with the prospect of the other having an effective strategic defence.

If on the other hand the shift is accomplished swiftly by one of both of the superpowers, there will be greater tension between the two than would otherwise be the case. The transition would still take place whereby both would deploy strategic defences. The greatest tension would arise in the case of one superpower deploying a full system in a short period of time before the other could adequately react. The latter state would be in a position of inferiority which it would want to rectify as quickly as possible. Unfortunately, it would be faced with attempting to deploy a full system not knowing whether the other would allow it. In the past, strategic superiority on the part of either the U.S. or the U.S.S.R. has not led to conflict and one would assume that the future situation would be similar. Thus a balance would be allowed to be struck or the slower state would be permitted, with the minimum of direct interference, to deploy its defence system. Regardless of how the shift or transition took place, it would take place such that the U.S. and the U.S.S.R. would have effective strategic space based defence systems.

The implications of a BMD deployment would not only arise for MAD, as was stated earlier, but also for nuclear deterrence in general. MAD would not be a practical strategy but as nuclear weapons will remain in the superpowers' arsenals, even with the deployment of a BMD, nuclear deterrence will continue to play a role in the U.S.-U.S.S.R. relationship. Conflict of opinion will occur when attempts will be made to define the exact nature of this role, particularly with the emphasis on defensive technology and strategy.

Nuclear weapons will not become extinct once a BMD is deployed but they will not remain as the dominant weapon system in the arsenals of the U.S. or the U.S.S.R. Even though nuclear weapons may become prone to technological advances in defence systems, they will be maintained and developed for various reasons. Until the BMD systems are actually deployed, nuclear weapons will be required as part of nuclear deterrence and once the systems are deployed, they will be kept in case the BMD's will not be effective. If the defence systems are effective, nuclear weapons will remain as there will be doubts about their degree of effectiveness and thus the possibility of being able to overwhelm the defence in the future. Another reason why nuclear weapons will not disappear, even if rendered obsolete, is the habit of military forces to retain weapon systems they are familiar with. The military forces in the U.S. and the U.S.S.R. have had forty years to grow accustomed to nuclear weapons. Certain branches of the services have developed vested interests that they will not want removed or lessened. This factor alone would ensure an incomplete and slow removal of nuclear weapons from strategic arsenals.

The retention of nuclear weapons will require the formulation of a nuclear deterrent strategy. The difference will be that it will be formulated while the dominant strategy is based on space based defence systems. With emphasis placed on the defence, it will be difficult to define a nuclear deterrent strategy that is viable and practical. Just as MAD incorporates aspects of defence, the shift will require nuclear deterrence to be incorporated as an aspect of an overall defensive strategy.

The change from dominant to subordinate strategy for nuclear deterrence will increase the complexities of the problem of perceptions in the security dilemma. Because nuclear deterrence will be retained, its inherent perceptional uncertainties, as outlined in the previous chapter, will remain for policy makers. The issue will become more complex when policy makers realise that a defensive strategy will increase the number of perceptional difficulties for them. Doubts will be raised concerning the effectiveness of both states' BMD systems. Inherent to this is whether the defence will be strong enough to counter offensive systems and whether advances will have been made by the opposition to strengthen their systems even further. The list will go on as more analysis of the topic is completed. Uncertainty of intentions and success of attack will increase proportionately as the problems of perception increase and become more complex.

These are not all of the issues involved when discussing the implications for nuclear deterrence but they are the major ones of importance. MAD will not survive the transition to the defence but nuclear deterrence will become an aspect of a defensive strategy. Only time will tell the exact rôle it will play.

Arms Race

The basis of the competition between the U.S. and the U.S.S.R. will remain the same as discussed in the previous chapter but there will be changes in the types of technology developed in the arms race. The security dilemma which the U.S. and the U.S.S.R. are caught in ensures that the race continues but only in a new and more complex direction. Once one of the states develops a defensive technology, the other must follow suit and thus there is now a defensive arms race going on. Fuelled by the security dilemma facing the U.S. and the U.S.S.R. and the mutual distrust between them, the arms race will not subside with the change in strategy but this change could exacerbate the present situation. An arms race is "an intense competition between opposed powers or groups of powers, each trying to achieve an advantage in military power by increasing the quantity or improving the quality of its armaments or armed forces" [3] This definition describes the history of U.S. - U.S.S.R. arms competition well (but the term arms race is a misnomer in that it implies there will be a winner and a loser whereas in reality there are only participants) and the U.S. and the U.S.S.R. are about to increase the level of competition by adopting defence based strategies.

Colin Gray has suggested that an arms race serves:

> ...to adjust power short of crisis and war; to satisfy a potentially aggressive state with an arms race victory (the arms race as cheaper substitute for war); to enable the international political system to accomodate a very rapid rate of military technological change; to buy time for techniques of conflict resolution to take effect; to ensure the continued dominance of status quo powers. [4]

Gray's list is relatively long and yet does not include any possible domestic purposes. Within states the military, industrial and bureaucratic establishments have stakes in the production of weapon systems and therefore provide more reasons for an arms race by seeing their survival, in some cases, tied to a continuing arms competition.

The military-industrial complex provides employment for people and money in the form of taxes for areas within the U.S. and the U.S.S.R. Any attempt to inhibit production of weapons would bring adverse political pressure upon a government whereas the development of new weapons technology would receive positive pressure from regions that could benefit from it. The military, in the form of inter-service rivalry, also applies pressure to maintain an arms competition. To gain prestige and the consequent budget dollars, different services tend to emphasise different weapon systems. Once the need for a system is tied to the prestige of a service or of the service's strategy, pressure is brought to bear on governments to ensure its survival, regardless if it is truly necessary. Domestic pressures are not all that maintain an arms race though.

The ideological differences and the distrust between the U.S. and the U.S.S.R. combine to ensure than an arms race will remain a symptom of the security dilemma. As long as there is a security dilemma, the arms race will survive and prosper. An argument could be made about the morality of emphasising armaments over trust but as long as two powers perceive each other as foes; weapons and the power that accrues from them will be seen as a safer and more logical form of diplomacy than trust based on words and emotion.

The U.S. and the U.S.S.R. are practitioners of the 'safer' diplomacy and consequently part of their strategic relationship since the end of WWII has been geared to an arms race in nuclear weapons. The Americans exploded their first atom bomb in 1945, the Soviets in 1949. They developed the thermonuclear hydrogen bomb in the early 1950's and by the late 1950's were developing ICBM's to deliver the bombs. Development followed development as the Americans depended on quality, the Soviets quantity. Strategic forces were and are continuously updated as the single warhead led to MARV which led to MIRV, as liquid rocket fuel led to solid propellant , and accuracies developed from a circular error probability [5] of hundreds of meters to tens of meters. After forty years of arms competition, the two superpowers have managed to go from a position of Soviet inferiority in 1945 to a position of relative strategic parity in 1985. Neither side can launch a first strike without suffering the devastating repercussions of a secure second strike. In other words, referring back to the definition of an arms race, neither side has gained a relative advantage over the other with offensive nuclear strategic weapons and so a new era begins with the introduction of new defensive weapon systems.

Even though only in the research phase, the new defence technology has already been the cause of arms race rhetoric between the U.S. and the U.S.S.R. (see Chapter III). If there is action to match the words, a new arms competition will begin.

The pressure to be the first or the best will drive the research, the development and the deployment of a space based defence system now that the decision to advance has been made and the impetus is in that direction. Once one state has developed or deployed an effective system, the onus will fall on the other to decide whether to match the move or leap frog it with their own advancements. The same mechanics which drove the offensive nuclear arms race will also drive the defensive arms race. The new and possibly disconcerting factor is that both arms races will be underway at the same time.

Hans Morgenthau's four paradoxes would be joined by a fifth as the U.S. and the U.S.S.R. competed to develop their nuclear arsenals and at the same time competed in a race to develop the technology to make those arsenals obsolete or redundant. Particularly during the transition phase when MAD would still be a viable strategy, the demand for limited resources within each state for offensive and defensive weapons would make for difficult decisions about which to support. Internal politics would have to be balanced against the other state's direction and speed of development of both types of weapon technology. Once the transition phase was passed, the situation would become more complex than before. The U.S. and the U.S.S.R. will have to decide whether to compete vigorously in the development of defence technology, to continue the development of the nuclear arsenals in the hope of eventually inundating a defence system or to respond to the new systems that would be deployed and attempt to modernise present offensive systems or develop an entirely new class of offensive weapons to counter the defence. Just as the security dilemma is driving the superpowers to adopt a defensive strategy, it would continue to drive them to go to the offensive counter after the deployment of the space based defence systems.

The decision makers in the U.S. and the U.S.S.R. have chosen or been driven to research and develop strategic defence weapon systems and the process will be a competitive one. But the process will also be in competition with the present offensive nuclear arms once it is carried to completion with the deployment of the system. The strategic relationship vis-a-vis the U.S. and the U.S.S.R. can only become more complicated and uncertain with the deployment of a BMD and this will be reflected in the arms competition and subsequently in arms control.

Arms Control

Arms control, as discussed in the previous chapter, is rife with problems which are not easily surmounted. As weapons become more complex and less easily categorised, the problems multiply such that any attempt at their control is thwarted by new technological advances or lack of political will. Hedley Bull described arms control as "restraint internationally exercised upon armaments policy, whether in respect of the level of armaments, their character, development or use." [6] The key phrase is "restraint internationally exercised." As there are no means available to punish transgressions of an arms control agreement, accommodation to an agreement has to be by mutual restraint. The governments of the states involved must have the political will and capability to support arms control or else there are no means by which an agreement would be effective. If the will was lacking, subject to the whims of domestic politics, or usurped by the desire to utilise the arms control process for other means, then any attempt at arms control will fail. If agreement is reached, it will be nullified by political insincerity and deception.

This last factor will become increasingly apparent with the development and deployment of the space based BMD system. The SDI which originally included only the U.S., has by formal invitation grown to include other European states and possibly Canada in the research phase. The repercussions of this action will be manifold when the systems are developed and deployed. Present arms control agreements will suffer and the ill feelings and emphasised distrust caused by this,will dampen or weaken the spirit of any future arms control talks.

The major arms control agreement to be adversely affected by the shift to the defence will be the "Treaty Between the

United States of America and the Union of Soviet Socialist Republics on the Limitation of Anti-Ballistic Missile Systems" [7] which entered into force on 3 October 1972. The main clauses of the Treaty are contained in Articles I, V, and IX. Article I states that "each Party undertakes not to deploy ABM systems for a defense of the territory of its country and not to provide a base for such a defense, and not to deploy ABM systems for defense of an individual region except as provided for in Article III of this Treaty," [8] and Article V states that "each Party undertakes not to develop, test, or deploy ABM systems or components which are sea-based, air-based, space-based or mobile land-based." [9] Article IX goes on to say "to assure the viability and effectiveness of this Treaty, each Party undertakes not to transfer to other States, and not to deploy outside its national territory, ABM systems or their components limited by this Treaty." [10]

It would seem at first glance that the ABM Treaty is a comprehensive document of international merit guaranteed to limit or restrain the spread of ABM systems. This is important as such a measure would ensure the survivability of the nuclear threat in MAD. Upon closer scrutiny, it is apparent that the Treaty has limitations. The Treaty is limited only to the U.S. and the U.S.S.R. and not to their allies. There are no restrictions into the research of ABM systems. Article IX limits the transfer of the systems but not the technology to develop them and either party can withdraw from the Treaty with six months prior notice to the other and a statement of the "extraordinary events the notifying Party regards as having jeopardized its supreme interests." [11] The limitations combined with successful research of effective ABM systems would offer different options to the superpowers.

First, either state could ignore the Treaty, develop and deploy the systems and abrogate the Treaty by their actions. The second option would be to go through the formal process of withdrawing formally from the Treaty and the third would require either of the states to acknowledge the Treaty formally and at the same time attempt to develop and deploy an effective ABM system utilising the built-in limitations. This could be stretched to the point where an ally is drawn in during the research phase so they would have the required technology to develop the different systems with financial assistance from the superpower. At the most extreme, this could lead to deployment of ABM systems by other states under the control of the superpowers which is a rather devicus approach to the problem but one which cannot be totally excluded considering the U.S.'s formal invitations to NATO allies.

Regardless of which option is chosen or why it is chosen, the repercussions for arms control would be negative in nature. If arms control agreements are ignored or reneged upon for a perceived moment of strategic superiority, it indicates a lack of political will to support arms control. If on the other hand, states attempt to comply but only by subterfuge, there is apparent insincerity and hypocrisy. Both of these would be discernible to the other superpower. The consequences would become evident when arms control talks would be entered into by the U.S. and the U.S.S.R. after the deployment of effective ABM systems. There would be talks to control the further development of offensive systems and talks to suggest guidelines for the further development of defensive systems or possibly talks of a combined nature to limit offensive weapons within the parameters of the defensive systems. Due to the previous withdrawal, abrogation or insincerity, however, it would be even more difficult for either state to link much importance to the word of the other. Distrust, already endemic to the relationship, would be intensified. This would be heightened to a greater degree as even more arms control agreements became threatened by the deployment of the defensive systems. For example, the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies [12] states in Article IV that "Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction,...or station such weapons in outer space in any other manner."[13] One of the most promising ABM systems, the X-ray laser (see Chapter II), requires a nuclear explosion to fuel it and thus would come into conflict with the Treaty.

Besides the legal, moral and political problems plaguing arms control, another problem is the difficulty in attempting to restrain or control technology and its spread. As the arms race enters the new phase envisioned earlier in this chapter, the problem will become almost insoluble. Not only will offensive and defensive arms have to be counted and controlled but they will have to be defined. What constitutes an offensive weapon; what a defensive weapon? The answer is not clear-cut and provides a clue to the immensity of the problem that will face arms control in the future. Time will not clarify the issue for arms control but only obfuscate the matter further. Already of limited success, arms control in a post ABM deployment role will have even a lesser chance to succeed.

All of the implications discussed thus far have dealt with the direct relationship between the two superpowers. Nuclear deterrence, strategic arms race and strategic arms control are dominated completely by the U.S. and the U.S.S.R. and thus attention is focussed on just their interchanges. In comparison, their military alliances involve numerous smaller states which will also be affected by the strategic shift to the defence. Considering the importance that the U.S. and the U.S.S.R. place on the military capabilities of the alliances, the implications of a deployed BMD for the members of the alliances should be examined. Unfortunately, there is a lack of Soviet and WTO information and so the remainder of the chapter will focus on the American alliances, NORAD and NATO.

NORAD

The North American Aerospace Defence Command (NORAD) is a bilateral agreement which the U.S. and Canada signed originally in 1958 and subsequently renewed in 1968, 1973, 1975, 1980 and 1981. It will again come up for renewal in 1986. In general terms, NORAD's role can be defined as:

> In addition to performing the airspace surveillance and control functions related to air defence, NORAD will monitor and report on space activities of strategic and tactical interest and will provide warning of aerospace events that may threaten North America. 14

More specifically and outlined by NORAD headquarters in November 1984, NORAD's main areas of responsibility include:

> -- Giving warning and assessment of ballistic missile attack, which is NORAD's most critical mission.
> -- Providing space surveillance to detect, track, identify and catalog earth-orbiting satellites.
> -- Furnishing reliable warning of an atmospheric attack, maintaining the peacetime sovereignty of U.S. and Canadian air space, and providing limited defence against an air attack. 15

To accomplish its first task effectively, NORAD depends on infrared satellites, a Ballistic Missile Early Warning System

(BMEWS) and the Sea-Launched Ballistic Missile Warning System which consists of phased-array radars on the east and west coast of the U.S. The second responsibility is accomplished with the use of a network of radar and optical sensors located around the world, the main component in the near future to be a Ground Based Electro-Optical Deep Space Surveillance System (GEODESS). The third and last task, air defence, is presently being updated to be effective for at least the next two decades. NORAD depends on nineteen squadrons of interceptors, seventeen American, two Canadian, which will be linked to a series of detection and warning radar systems. The East, South and West coasts of North America will be defended principally by an Over-The-Horizon Backscatter (OTH-B) high frequency radar system [16] all located in the U.S. The planned North Warning System (NWS) [17] located in Alaska and Canada will provide coverage for the Northern approaches to North America. Commander in Chief of NORAD is a U.S. Air Force general who is concurrently head of the Aerospace Defense Command and the Space Command. The Aerospace Defense Command is responsible "for the unilateral aerospace defense of the United States" [18] and Space Command is responsible for the operation and management of U.S. strategic defence assets in space. The Deputy Commander in Chief is a Canadian general who will assume responsibility for the command of NORAD in the absence of the Commander in Chief.

In contrast to the present, emphasis in NORAD was originally placed on the air defence of North America from Soviet long range bombers. With the advent of the ICBM and SLBM however, it was realised that the long range bomber, which is relatively slow, would only be effective as a follow on system after a strike by the then invulnerable ballistic missiles. Air defence was relegated lower and lower priority until the development in the last five years of a credible long range Soviet cruise missile. Carried by either the Bear, Bison, Backfire or new Blackjack bomber, the Soviets could launch the cruise missiles from ranges up to 1500 nautical miles from American continental targets and then turn away without coming into range of the air defence forces. The new threat has encouraged and emphasised the requirement for updating NORAD air defence capabilities and systems.

NORAD's past has also often been marred by the reluctance of Canadian governments to cooperate with the U.S. in mutual defence matters. As is apparent from the listing of NORAD systems, Canada's defence measures have preponderantly fallen within the role of air defence. During the period of a perceived lack of realistic long range bomber threat when "a follow-on Soviet bomber attack (appeared) to be of only the most marginal significance,"[19] the Canadian governments found it difficult to justify its role in NORAD to the Canadian populace and yet not anger the American decision makers.

> Canada has to walk a fine line in its policies on North American air defence, balancing its own national requirements with the need to respond to the Soviet threat and the imperatives of its relationship with its neighbour. As Professor Cox remarked, one requirement of an effective pursuit of national sovereignty is that Canada should not act "in such a manner as to invite... an unsympathetic policy on the part of the United States." 20

The NORAD agreement was renewed each time to balance defence, sovereignty and the fear of unilateral U.S. actions. The balancing act, combined with the Mulroney government's decision to approve the joint program to deploy the NWS has ensured the existence of NORAD for the time period covered by this thesis. The previous early warning systems located in Canada were operated for the most part by the U.S. Air Force but in an attempt to strengthen and assure Canadian sovereignty in the North, Canada will control the NWS. Because of the greater Canadian control and consequently a greater role in continental defence, there is a greater impetus for the survival of NORAD than in the past. The NWS is inexorably linked with the U.S. OTH-B (which does not work in the North due to the effect of the aurora boreallis) and U.S. air defence sysytems. Any attempt by a Canadian government to abrogate the NORAD agreement in the future will leave the U.S. in a vulnerable position to what they consider a viable threat. Therefore to ensure the U.S. does not take unilateral actions to defend itself, Canadian governments will have to renew NORAD. As a superpower, the U.S. will do everything in its power to survive, even if that means impinging on Canada's sovereignty.

Since NORAD will continue to exist, it will be affected by the development and deployment of a strategic BMD system based in space. The implications will be felt particularly by Canada in a NORAD context as opposed to the U.S. which is instigating the strategic shift with the SDI. Though formally invited by the U.S. to join in the SDI, Canada has so far refrained from responding in recognition of the delicate political nature of the subject in Canada. Time will bring more U.S. pressure for Canadian cooperation in all phases of a strategic defence regardless of the Canadian response to this initial request. The reasons for this and the options available to Canada in response to the pressure will serve as the vehicle to demonstrate the strategic implications for NORAD.

The major reason for the pressure has to do with a factor that Canadians have no control over whatsoever and is related to Canada's geostrategic location. Geographically, Canada occupies the Northern half of the North American continent and the U.S. the Southern half. Canada will also remain in the unenviable position directly between the U.S. and the U.S.S.R. as the ballistic missile flies. R.J. Sutherland states that this factor ensures "that the United States is bound to defend

Canada from external aggression almost regardless of whether or not Canadians wish to be defended."[21] In other words, the U.S. will ensure Canada is secure to keep its own Northern boundary secure. In addition, Canada has a large land mass that the U.S. can utilise to good effect to provide early warning of an incoming Soviet threat and to interdict the Soviet threat before it reaches U.S.soil. Canada acts as a cushion for the U.S. strategic forces. With forewarning measures based in the north, the U.S. can ensure the survivability of its second strike force and allow plenty of reaction time for interceptors to scramble and destroy the bombers over an unpopulated or less populated region.

These factors will gain importance with the deployment of a multi-tiered strategic defence system for a number of reasons. First, the low altitude defence tier and the mid-phase tier depend on ground launched systems and to some extent ground based sensor systems. The closer to the Soviet RV's in either phase of their flight the U.S. systems can be stationed, the greater the accuracy for the sensors and therefore the ABM's. This means that the optimal deployment would be as far north towards the U.S.S.R. as possible, preferably on Canadian Arctic territory. Secondly, if the ABM system is in the far North, there is a greater chance that the RV's will be intercepted over Northern Canada which is relatively unpopulated compared to the northern U.S. This is important as it is believed that certain RV's will be rigged to explode on contact or if they encounter any interference during their flight. Minimal damage to population centres would occur if the explosion was to occur over Canada rather than the U.S.

A third reason has to do with the growing strategic importance of the Arctic as a Soviet SSBN operational area. An SSBN depends upon the range of its missiles and its ability to attain a launch position undetected for its effectiveness and survivability. The range of its SLBM's determine which oceans they can operate in and how close they have to be to the U.S. continental targets. Their inability to operate undetected has hampered the Soviet SSBN fleet in the past due to NATO efforts to control or monitor the choke points vital to the Soviet fleet. "By the late 1970's and early 1980's, the monitoring methods included satellites, seabottom-mounted acoustical devices, sonar arrays towed by ships and aircraft, long range patrols by sonar-equipped aircraft, patrols by sonar-equipped destroyers with sonar-equipped helicopters on board and by attack submarines, and mining." [22] The consequences of such actions were that the Soviet SSBN fleet could only operate in the Arctic Ocean undetected, as many of the monitoring devices were not functional in the sea-ice environment, and the SSBN's could enter it direct from the Kola Peninsula without passing through choke points. The restriction to the Arctic Ocean has actually been an advantage for the Soviets for the above reasons and because new long range SLBM's introduced in the 1970's have given the Soviets the ability to operate undetected within range of U.S. continental targets and Western European NATO targets. (See Appendix I for range plots of some Soviet SLBM's using polar projection map).

Canada, by having an Arctic Ocean coastline, once again is in the unfortunate position of being directly between the U.S. and a Soviet SLBM threat. The Soviet SLBM, launched from the Arctic Ocean would be subject to all of the tiers of the ABM system, but because of its proximity to the U.S., would provide less warning time unless detector systems linked to a ground based charged particle weapon system were deployed in the Canadian Arctic. If a charged particle weapon were to become effective, its engagement time and speed would pose a serious threat to SLBM's still in their boost phase.

A fourth reason for the increased importance of Canada's geostrategic location pertains to NORAD's conventional air defence role. As the BMD system is deployed and becomes effective, increased emphasis will be placed on the long range bomber in a standoff role. Most of the proposed ABM systems will not be suitable against a low level bomber or cruise missile attack. Conventional jet interceptors with a look down-shoot down capability offer the greatest chances of success against such an attack. If the Soviets increase their bomber and cruise missile forces in response to the BMD system, a larger effort will be required from NORAD to counter it. Like the 1950's, when Canada's large size served as an effective anti-bomber factor, it would once again serve the same role as an anti-cruise missile factor. Canada's large size, in conjunction with the North based NWS and associated North based interceptor units, would serve as the most effective combination against the bomber threat. The increased distance to be covered would allow more time for the interceptors to carry out their search and destroy missions.

Geostrategic factors may be the major reasons for increased American pressure on Canada to join in the research, development and deployment of a space based defence system but they would not be the only ones. Economic factors will provide strong incentive to participate with the U.S. particularly if the U.S. is willing to lift restrictions legislated on defence contracts. For example the NWS will cost $600 million for Canada but as Deputy Prime Minister and Minister of National Defence, the Honourable Erik Nielsen states:

> The industrial benefits from this project [NWS] will, at the very least, equal national expenditures on it. More than 11,500 person-years of employment will be generated in the communications and construction industries during the eight year modernization program. I am confident that the project experience will help open world markets for Canadian industry, and for our highly skilled communications industry in particular. 23

Imagine the pressure on a Canadian government in a time of economic recession to participate in a program which is expected to cost U.S.$100 to $200 billion. The temptation is there to get in first to gain the most economically and in terms of technological spinoff. The economic factor could play a large role in a Canadian decision especially if employment could be guaranteed from certain aspects of the proposed defence systems by a politician running for reelection.

Another factor which could pose a problem for Canadian officials is the political pressure the U.S. or internal Canadian actors could bring to bear to maintain the solidarity of the agreement in the face of American criticism and a Soviet threat. A united front by the U.S. and Canada in terms of North American defence would serve to assuage critical opinion in the U.S. and Canada. If Canada was to resist and not participate, the U.S. administration could be open to greater criticism by Congress than if Canada was seen to be willfully cooperating with the U.S. However, problems arise for Canadian officials if they are perceived as too willing to cooperate with the U.S. No Canadian politician wants to be accused of selling out to the Americans, especially when sovereignty is an issue. This factor has been minimised, however, by the U.S.'s formal invitations to all NATO members and not just Canada, to join in the benefits of the defence system. Therefore the pressure is diluted among a greater number of states and the Canadian government is not forced to respond quickly or thoughtlessly on this issue.

Perhaps the last important factor is one that is not thought of very often when discussing strategy as it applies to Canada. Since the introduction of strategic nuclear weapons, Canada has attempted to stay non-nuclear, not always successfully, knowing that it could depend on the U.S. nuclear umbrella as a deterrent. It was an approach which has led to a deemphasis of the degree to which Canada is probably targeted for a nuclear strike and instead focussed attention on probable damage from faulty RV's targeted on the United States or fallout from the U.S. A continuation of this belief is that as Canada becomes part of the U.S. BMD effort by accepting sensors or weapon systems on Canadian soil, they will become targets for a nuclear strike, thus causing greater destruction in Canada than would otherwise be the case. It is true they would be targeted but considering that Canada is already targeted to a great extent by the Soviets, the extra damage would be minimal in comparison. Canada is probably considered as part of the North American target in general as much as Eastern European states are considered by the U.S. as credible Soviet targets. Canadian industrial centres, large cities and military facilities would be just as prone to nuclear devastation as their U.S. counterparts if the Soviets were at all efficient in their nuclear planning. Canada is a target regardless if ABM systems are accepted or not or if Canada is non-nuclear. If this fact starts to be accepted by a large number of Canadians, pressure could be brought to bear to participate in the defence systems as a means to increase the chances of Canadian survival. If Canada was to be involved from the start, action could possibly be taken to ensure it will not be the battleground between U.S. ABM systems and Soviet nuclear offensive systems because if Canada does not participate and refuses to accept U.S. defence systems on its soil, the U.S. will be forced to deploy the systems in the Northern States thus using Canada as a battleground. It would be a change for Canadians to realise they are nuclear targets, but it would be a bigger change for them to realise that they might be able to do something about it by assisting in the development of a continental defence system.

Taking into consideration all of the aforementioned factors and pressures, the Canadian government will have to choose an acceptable option or plan of action to account for the changes inherent in the strategic shift. It will have to decide whether to opt out or become involved and to what extent, or try to adopt a position of compromise towards U.S. pressures to cooperate and Canadian sovereignty interests. If Canada decides to ignore the pressures and opt out of the SDI and the development and deployment phases, it must decide whether to renew NORAD or not. The U.S. is going to want to bring NORAD more into line with Space Command and Aerospace Defense Command to ensure operational congruity and defencive cohesiveness. If Canada adopts an anti-defence strategy stance in terms of the BMD system, it will be difficult then, to renew a NORAD agreement which is actually part and parcel of that system.

Another option for Canada would be to accept the inevitability of the strategic defence system, attempt to cooperate fully with the U.S. and accept the extended responsibilities of NORAD. This option would have the benefit of moving the battlefield further away from Canada and it would also require a smaller commitment in men and dollars by Canada because the U.S. could be allowed to do everything to make the system effective. The greatest difficulty would arise around the issue of Canada's sovereignty or lack of it, particularly in the North where most of the systems would be deployed. The question would always be if Canada depends wholly on the U.S. for its survival, how much control would the U.S. have on internal political issues or how much impact would this have on foreign policy? No answers are available and it is doubtful that a Canadian government would ever want to be in a position where it would have to supply the answers.

In all likelihood, Canada will adopt a compromise solution somewhere between the two former options. It would attempt to reap the economic benefits of participation, influence U.S. deployment policy to Canada's greatest benefit, ensure adequate Canadian control to give the perception of sovereignty and at the same time keep material costs to a minimum. Against this stance, the U.S. would attempt to retain complete control of all phases of development and deployment and at the same time get Canada to help pay more than it is probably willing for the system. NORAD will remain but changes will be required to coordinate its activities with the continental space based defence system. The U.S. will develop the system regardless of Canadian views, but there is always the chance that Canadian cooperation will permit some shaping of the final deployment by Canada and in Canada's favour. It will be difficult to determine the precise level of compromise considering the number of factors involved, but it is apparent that it will be necessary to attain an acceptable option for the role of Canada in NORAD in a more complete strategic defence system.

NATO

In addition to NORAD, the deployment of the space based strategic defence system will affect the fourteen other member nations of the North Atlantic Treaty Organization (NATO). In addition to the U.S. and Canada, Belgium, Denmark, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Norway, Portugal, Spain, Turkey, the United Kingdom and West Germany are members of NATO. As a whole, they will be drastically affected by the deployment of a strategic defence system by the U.S. and the U.S.S.R. The alliance will continue to exist but under different parameters and with much greater responsibility being assumed by the European members than is presently the case.

NATO was formed with the ratification of the North Atlantic Treaty in 1949 after two years of secret talks and political persuasion. The motivation for governments to join the alliance varied.

> The Europeans, in general sought to ensure an American guarantee of their security. The United States aimed to strengthen the sagging democracies of Europe. Canada strove to build a multilateral framework in which it could more safely cooperate with its sometimes overpowering neighbour, the United States. [24]

More specifically, there were economic, political and military needs which could only be filled by a collective security alliance. Economically many of the European states were ruined or devastated by WWII and were having difficulty recovering. NATO membership meant "billions of dollars worth of military as well as infrastructure aid" [25] with which to reconstruct economies. Politically there was a need for a method to counter the Soviet supported Communist parties which were growing stronger in Western and Eastern Europe. During the period from 1947 to 1948, Communist parties had managed to gain control of Hungary, Bulgaria, Rumania, Poland and Czechoslovakia and the Soviet Union was exerting political pressure in Northern Iran, Turkey and Greece. The formation of NATO was seen as a possible method of calming the fears of Western European states threatened by Communist actions. "Formal ties with the major Western powers were seen as a counterweight to the dangers of infiltration and of possible coups" [26] by indigenous Communist parties.

The greatest motivation for the formation of a collective security alliance was supplied by the Soviet Union's military forces. Immediately after WWII, the Allied forces in Europe had demobilised their large armies.

Table III Allied Force Levels Immediately After WW II [27]

Country	1945 (men)	1946 (men)
United States	3,100,000	391,000
United Kingdom	1,321,000	488,000
Canada	299,000	0

France was not yet able to militarise effectively and West Germany was not permitted to by the Allies. In contrast, the Soviet Union armed forces amounted to more than four million men supported by active war industry. [28] The first response to the Soviet threat by the European states was in the form of a treaty of mutual assistance (The Brussels Treaty) signed by Belgium, France, Luxembourg, the Netherlands and the United

Kingdom in 1948. In itself, the Treaty did not provide enough forces to counter the U.S.S.R. effectively but it and the Berlin Blockade provided the base and the impetus for the U.S., Canada and other European states to become involved in European defence and thus in April 1949 NATO was formed.

The North Atlantic Treaty was founded on the main principle that its signatories were "determined to safeguard the freedom, common heritage and civilization of their peoples, founded on the principles of democracy, individual liberty and the rule of law." [29] To accomplish this, Article 3 of the Treaty states that "the Parties, separately and jointly, by means of continuous and effective self help and mutual aid, will maintain and develop their individual and collective capacity to resist armed attack." [30] To further increase the sense of solidarity among the NATO members, a pledge of assistance was inserted into the Treaty in the form of Article 5 which states that "the Parties agree that an armed attack against one or more of them in Europe or North America shall be considered an attack against them all and consequently they agree that, if such an armed attack occurs, each of them, in exercise of the right of the individual or collective self-defence recognised by Article 51 of the Charter of the United Nations, will assist the Party or Parties so attacked by taking forthwith, individually and in concert with the other Parties, such action as it deems necessary, including the use of armed force, to restore and maintain the security of the North Atlantic area." [31]

In practical terms, NATO, the embodiment of the Treaty, has led to mutual cooperation among the members' military forces to an extent never before realised in times of peace. Each member has delegated forces to be used and controlled by NATO or more specifically NATO's supreme body, the North Atlantic Council (NAC), and the Defence Planning Committee (DPC) of the Council. Advice on military matters is provided by the Military Committee to the NAC/DPC as well as to the three principal NATO commands - Atlantic, Europe and Channel. To provide administrative support for the above Committees and Council and to carry on the day-to-day work, is the responsibility of an International Secretariat and an International Military Staff.

The purpose or aim of the unprecedented cooperation in peace time is to ensure the security of Europe by deterring the Soviet Union from attacking and in the case it does attack, provide an effective defence. To accomplish this aim, NATO has adopted a strategy of forward defence and flexible response. Forward defence implies that "should large-scale conventional aggression occur, these forces should be capable of sustaining a conventional defence in the forward areas sufficient to inflict serious losses on the aggressor and convince him of the risks of continuing his aggression."[32] Flexible response means "the Alliance must be able to respond in an appropriate manner to aggression of any kind; the response must be effective in relation to the level of force used by the aggressor and must at the same time make him recognise the dangers of escalation to a higher level."[33] A triad of conventional, tactical nuclear and strategic nuclear forces are required to effectively implement the strategy. Each leg of the triad should pose a credible threat on its own to an aggressor and should combine efficiently to provide deterrence and defence against the Soviet Union and the WTO.

To illustrate the strategy in terms of forces available, the following tables of force comparisons between NATO and the WTO are provided. A comparison of the strategic nuclear forces has been provided by Tables I and II in the introductory chapter.

Table IV Conventional Force Comparison Between NATO and WTO[34] (1983/84)

	NATO	WTO
Manpower (000)		
Total in Uniform	4,991	6,068
Total Ground Forces	2,691	2,643
Total Ground Forces in Europe	1,986	1,714
Reserves (All Services)	5,345	6,718

continued ...

continued Table IV

Equipment	NATO	WTO
Tanks	20,722	25,490
Artillery	8,996	11,830
Naval Units	1,429	1,704
Naval Aircraft	1,185	762
Landattack Aircraft and Fighters	5,028	7,572 [a]

a. Can be reinforced quickly with 2300 more aircraft from Western and Southern Theatres.

Table V Tactical Nuclear Systems Comparison Between NATO and WTO (1984) 35

	NATO	WTO
Missiles	224 [a]	983
Aircraft	1,078	3,260
Short Range Systems [b]	1,876 [c]	1,710 [d]

a. This figure is to be gradually increased by the addition of 500 Tomahawk GLCM and 60 Pershing II IRBM's.

b. This figure includes nuclear capable artillery and short range missiles.

c. This figure does not include the Americans' 4,153 artillery pieces which are divided between North America and Europe.

continued...

Table V continued

d. This figure does not include the unknown number of Soviet nuclear capable artillery, but only the artillery for the other WTO forces.

The one fact that is obvious from the tables is that there are a large number of armed forces, conventional and nuclear, situated in Western and Eastern Europe ready to deter aggressors from attacking and ready to defend their territories if attacked. Such is the situation and such has been the situation since 1949. As long as a threat is perceived from the Soviet Union, a factor of the security dilemma, NATO forces will remain in being and in position for the foreseeable future. European survival is dependent upon the capabilities and effectiveness of the flexible response triad of forces. But what if one leg of the triad, the strategic nuclear forces, becomes redundant or incapable of carrying out its role? Such a scenario would occur if the U.S. and the U.S.S.R. deployed effective strategic defence systems. The consequences for NATO could be decisive.

In reality, the strategy of flexible response as emphasised by NATO commanders, has ultimately depended on the U.S. strategic nuclear forces for its credibility. When comparing the WTO and NATO in terms of conventional manpower or equipment, there is an element of subjectivity involved, nevertheless, it is agreed that the WTO has a numerical advantage and is quickly gaining on NATO's technological edge.[36] It would be risky to launch a conventional attack against NATO but as long as there is a possibility of defeating NATO, emphasis will be placed on NATO's strategic nuclear capability for deterrence rather than its conventional forces.

Unfortunately, the second leg of the triad, the tactical nuclear weapons, does not pose as credible a threat when it is isolated from the U.S. nuclear force. It is neither a good deterrence nor a good defensive strategy on its own. To be effective as a deterrent, NATO's tactical nuclear force would have to have the ability to survive a surprise Soviet strike and then be able to strike a large blow to Soviet military forces, industry and population. There is no question a limited capability would survive a first strike, especially the French and British SLBM's, but there would not be the assured destructive capability that is present with U.S. strategic nuclear forces. There would also be a doubt whether European politicians would be willing to use tactical nuclear weapons in any role. Many of the WTO targets in Eastern Europe would be close to Western Europe thus requiring the political will to bomb WTO targets with the knowledge that there will be damage and casualties in their own territory from their own bombs. Secondly, if WTO and NATO forces were in combat, they would be in close quarters and on NATO soil. The use of tactical weapons in this case would ensure casualties, both military and civilian, and devastation again within their own forces and territory. Thirdly, there is always the possibility that not every NATO member would be willing to use any tactical nuclear weaponry for fear of escalation beyond a controllable point. Britain, France or one of the smaller European members could decide that they will not use nuclear weapons in the defence of West Germany or Turkey if they were assaulted. The probability is that there will be no hesitation but Germany or Turkey would not like to be in the position of only finding out in the event of an attack upon themselves. Article 5 states the response by NATO members is not unlimited in case of aggression but rather limited to "such action as it deems necessary."

Though it is evident the tactical nuclear forces are not adequate in and of themselves and there is some doubt as to the political will to use them, they will remain in NATO's arsenal if only to provide a trigger in the escalation process for the U.S. strategic nuclear forces and as a response to the WTO use of tactical nuclear weapons. Governments may be afraid to use them in time of war but in times of tension, they may be more afraid not to threaten to use them to ensure the U.S. deterrent on their behalf.

Once tactical nuclear weapons were used in Europe by either side, it is likely the other would retaliate in kind, striking at opposing nuclear forces, conventional forces, and population centres. In this situation, NATO's European members would be devastated, leaving the U.S. the only option of rescuing its allies by striking the U.S.S.R. with its ICBM's, SLBM's and long range bombers. Conversely a NATO tactical strike would possibly damage U.S.S.R. strategic systems, leaving the U.S.S.R. at a perceived strategic disadvantage vis-a-vis the U.S. In order to redress the situation, the U.S.S.R. would be forced to launch a first strike upon the U.S. before the U.S. struck the remainder of its nuclear forces. Therefore the use of tactical nuclear weapons serves as a deterrent because their use would be the first step to an inevitable strategic exchange.

However, problems will arise for NATO, particularly the European members, when the U.S. and the U.S.S.R. deploy their space based defence systems. The BMD systems could effectively neutralise all ballistic missiles which include ICBM's, SLBM's, IRBM's and MRBM's. This would in effect remove the strategic forces and most of the long range tactical nuclear weapons from the NATO triad. This factor would have two major effects on NATO. First the French and British independent nuclear forces would no longer be effective deterrents against the Soviets or Americans and no longer would Europe be able to depend upon the nuclear deterrent to avert war but instead would have to depend on a dyad of the remaining tactical nuclear systems and conventional forces available in Europe.

The British nuclear forces are actually not independent but are interdependent systems which depend on American technology for the SLBM's they own and are also closely linked with orthodox NATO strategy. They would however, be struck just as ineffective as the independent French force de frappe by an effective strategic defence system. Because of the nature of the two forces, the effects would be felt differently by Britain and France. As Lawrence Freedman points out, the British offer two arguments to justify the existence of their force, the first political, the second strategic. First, having the force offers more "opportunities for the exercise of benign influence when all nuclear issues, from disarmament to NATO planning, were discussed." [37] and secondly "it was often presented as a simple assertion that in a cruel and uncertain world, where others may get nuclear weapons and the United States' own willingness to engage in nuclear war on Europe's behalf was open to doubt, an independent British force was a necessary form of insurance." [38] With the deployment of the defence system, the British would lose political influence on nuclear matters and would no longer be required as a 'necessary form of insurance.' These would have to be weighed against the gains for Britain agreeing to participate in the SDI which the U.S. is paying for from the earliest moment possible and the economic gain of not having to stretch the defence budget to update continuously its nuclear forces at the expense of the conventional forces. All in all Britain could actually be better off politically, economically and militarily by a decision to be non-nuclear and pro-defence.

Originally France, under De Gaulle, rationalised its independent force de frappe on the basis of political considerations. De Gaulle "saw nuclear weapons as a way of providing France with a distinctive identity and a power base from which to criticize the hegemonic aspirations of the United States." [39] Nuclear dependence on the U.S. would create political dependence within the Alliance if France assumed a non-nuclear role. With time and due to inherent flaws in De Gaulle's strategy, [40] France has been drawn closer to the NATO alliance strategy. The deployment of a strategic defence system would finalise France's shift back towards NATO as it would be forced to realise that otherwise its independent stance would mean less in a strictly conventional encounter between NATO and the WTO. It would be forced to scrap its nuclear force or else attempt a costly update to counter either the Soviet or American BMD. Its present policy position against the SDI and the strategic defence concept could also be to France's detriment in future political discussions. If France does not participate willingly in the early stage of research and development, it could possibly be politically isolated depending upon the amount of opposition it offers when the system is finally deployed by the U.S. in conjunction with willing NATO partners. France cannot and will not be able to afford politically or economically, to continue with an independent strategic policy in light of the deployment of an effective space based strategic defence system.

NATO would also be affected in that defence and deterrence would be a function of a dyad of short range tactical nuclear weapons and conventional forces. Forward defence would no longer be a valid strategy and changes would have to be made in NATO force structures to accommodate the strategic shift. The forward defence strategy, which depends upon a full flexible response triad, would have to be changed to a strategy of defence in depth. The reason for this is that as originally envisioned, NATO's forces would be concentrated in a long front line facing the WTO and once the WTO threatened to succeed in an attack, nuclear weapons would be used on a tactical and strategic level to deter them from continuing. Unfortunately for NATO, the removal of the strategic and long range tactical threat imposes different parameters on the defensive strategy. Without strategic nuclear support, WTO forces breaking through the NATO front would not face an effective deterrent to further advances. NATO does not have enough mobile reserves behind the front to pose many conventional difficulties for WTO forces and it is highly unlikely that tactical nuclear weapons would be used by NATO forces on NATO soil especially since the opposing forces would be in continuous close contact with NATO troops. To offset this problem, NATO will have to deploy a conventional defence [41] in depth to counter a WTO thrust. The advantages of a redeployment would be to offer a stronger defence less susceptible to an attack by short range tactical nuclear weapons. Forward defence was more vulnerable to a preliminary WTO bombardment because of the concentration of NATO forces into a smaller area. The disadvantages are that destruction would be more widespread as it would take more territory for a defence in depth to defeat a WTO offensive thrust. This would mean that states such as Germany and Turkey would suffer close to total destruction so as to be able to absorb an attack. The power of present conventional weapons is many times greater than those used in WWII and their effects would be detrimental to a state that would have to depend on territory to defeat an enemy.

To adapt to the new strategy, NATO will have to make changes in its present force structure. Defence in depth requires greater mobility, a greater dependence on conventional forces and well trained, well motivated soldiers taught to adopt the initiative on a flexible battlefield. Tactical nuclear weapons would still serve as an effective disruptive element in a WTO advance before it came into contact with NATO forces and on reserves in the rear, concentrating to advance behind the main assault, but they would no longer serve as the strategic nuclear trigger for NATO. Consequently, for defence to succeed, expenditures on conventional forces will have to be emphasised so as to adapt systems to a more fluid battlefield situation. Greater mobility on the battlefield will be required in the form of armoured infantry personnel carriers and greater firepower will have to be more accessible to smaller independent units for defence in depth to function. Economic costs should not increase for NATO members relatively as it will be more a matter of better utilisation of ~~what~~ one has than buying more of it. Manpower will have to be better trained as defence in depth can be costly if there are major weaknesses in any of the NATO armed forces. As in any defence, it is only as strong as its weakest link. Thus more cooperation and standardisation of training techniques will be required of NATO in the future to ensure a common high calibre of conventional force.

The conventional force could be more European as pressure would mount in the U.S. to reduce or withdraw its conventional forces which are seen more as insurance of American strategic involvement in Europe than as a conventional fighting force.

The future holds the promise of change for NATO but it will not come without its costs and problems. Political influence will shift within the Alliance and military strategy and force requirements will have to adapt to the changes. A de-emphasis of the strategic nuclear deterrent means NATO will have to emphasise conventional forces and strategy to act as deterrents to the WTO. Perhaps this will mean a greater chance for a European war if NATO becomes destabilised to the point of disbandment but it would also provide less of a chance for escalation to a strategic exchange. If the BMD becomes a divisive factor for NATO, the subsequent disarray could provide opportunities for the WTO to expand and thus make conflict more likely.

It has become evident that the SDI and the subsequent development and deployment of a space based strategic defence system has many strategic implications for the arms race, arms control, NORAD and NATO. The arms race will continue in a new direction causing untold problems for arms control. As arms control continues its lack of success in a more complex world, greater importance will be attached to the roles that alliances such as NORAD and NATO will adopt so as to control successfully and structure a changing strategic imperative. This chapter has attempted to speculate on the difference a strategic shift will make. It is hoped that though the ideas may not be accepted , they will provide impetus for future study into the strategic implications of BMD systems. The more foreknowledge that can be provided, the greater chance of proper steps being taken on the part of decision makers in the future.

Notes

1. J.H. Kahan, Security in the Nuclear Age, (Washington: The Brookings Institution, 1975), p. 94.

2. U.S. Government, The President's Strategic Defense Initiative, (Washington: Government Printing Office, 1985), p. 3.

3. H. Bull, "The Objectives of Arms Control," in R.J. Art, Waltz, (ed.), The Use of Force, (Boston: Little, Brown, 1971), pp. 350-351.

4. C.S. Gray, "The Urge to Compete: Rationales for Arms Racing, "World Politics, 26(Jun 74), p. 232.

5. Circular error probability is a figure used to designate the accuracy of a ballistic missile. It is the radius of a circle within which a RV has a 50 % chance of falling.

6. Bull, p. 349.

7. B. Jasani, (ed.), Outer Space - A New Dimension of the Arms Race, (London: Taylor & Francis Ltd., 1982), pp. 375-379.

8. Jasani, p. 375.

9. Jasani, p. 376.

10. Jasani, p. 377.

11. Jasani, p. 378.

12. Jasani, pp. 370-374.

13. Jasani, p. 371.

14. Canada, Department External Affairs, "NORAD Agreement Renewal," Communique, 23(11 Mar 81), p. 32.

15. NORAD Command, "North American Aerospace Defense Command, "NORAD Fact Sheet, (01 Nov 84), p. 2.

16. B. Blake, "Beyond the horizon - a new concept in detection," Jane's Defence Weekly, (17 Mar 84), pp. 1-3.

17. The Canadian part of the NWS will consist of 39 unmanned microwave radar units as well as their communication system. Canada will be responsible for building and maintaining the radar units. For more information see: M. McDonald, "An ominous Arctic shield, "Maclean's, 98(04 Mar 85), pp. 12-14.

18. NORAD Command, p. 3.

19. C.S. Gray, "Canada and NORAD: A Study in Strategy," Behind the Headlines, 31(June 74), p. 13.

20. Special Committee of the Senate on National Defence, Canada's Territorial Air Defence, (Ottawa: Minister of Supply and Services, 1985), p. 35.

21. R.J. Sutherland, "Canada's Long Term Strategic Situation," International Journal, 17(Summer 62), p. 202.

22. W.H. Critchley, "Polar Deployment of Soviet Submarines," International Journal, 39(Autumn 84), p. 836.

23. Government of Canada, Statement on motions on air defence modernization by the Deputy Prime Minister and Minister of National Defence, the Honourable Erik Nielsen, (Ottawa: Department of National Defence, 1985), p. 3.

24. G. Wright, "NATO in the New International Order," Behind the Headlines, 36(1978), p. 4.

25. N. Orvik, "NATO: The Role of the Small Members," International Journal, 21(Spring 66), p. 174.

26. Orvik, p. 174.

27. NATO Information Service, NATO Facts and Figures, (Brussels: NATO Information Service, 1976), p. 12.

28. NATO Information Service, p. 12.

29. NATO Information Service, p. 300.

30. NATO Information Service, p. 301.

31. NATO Information Service, p. 301.

32. NATO Information Service, p. 347.

33. NATO Information Service, pp. 346-347.

34. International Institute for Strategic Studies, The Military Balance 1983-1984, (London: IISS, 1983), pp. 138-139.

35. B. Bennell, "Soldiers fear loss of advantage at talks," The Globe and Mail, (07 Jan 85), p. 4.

36. International Institute for Strategic Studies, p. 137.

37. L. Freedman, The Evolution of Nuclear Strategy, (New York: St. Martin's Press, 1981), p. 311.

38. Freedman, pp. 311-312.

39. Freedman, p. 321.

40. Freedman, pp. 322-324.

41. A well illustrated example of a defence in depth is provided in P. Griffith, Forward into Battle, (Sussex: Antony Bird Publications Ltd., 1981), pp. 78-79. Griffith outlines the evolution of the German web defence adopted in WW I by Germany on the Western Front.

CHAPTER V

Conclusion

I have attempted through this thesis to discuss the implications on the U.S. - U.S.S.R. strategic relationship of a shift from an offensive oriented strategy to a defensive oriented strategy. The technology required to implement the transition was outlined in Chapter 2 in enough detail to support the original assumption that it is likely that the means to deploy a space based BMD will be present eventually, if not within the next twenty years. The consequences of such an action were discussed in general terms, as per the original intention, with emphasis on the theoretical and practical strategic implications.

The theoretical discussion was focussed on the inherent tensions and problems of nuclear deterrence strategy and how they, in conjunction with the well described security dilemma, have instigated the need for a new strategy. The strategy most likely to succeed deterrence strategy, it was concluded, was a defensive strategy based on an effective BMD system. The deployment of a BMD system would affect the MAD strategy negatively and render it obsolete because the threat of mutual destruction would no longer be viable, thus no necessity to fear misperception of will to use nuclear weapons.

The transition to a defensive strategy would have practical implications for the U.S. and the U.S.S.R. A new arms race would be stimulated by the requirement for one state not to be outdone by the other in a defensive weapons competition. The new arms race would highlight the failure of past arms control talks and the weaknesses in present arms control agreements. As the desire to depend on their own material resources increased, the alliances of the two superpowers would be affected. Information and knowledge on the Soviet Union's relations was scarce as compared to the U.S., so analysis was focussed on NORAD and NATO. A U.S. deployed BMD system would present problems for Canada in NORAD because of mainly geographical and political pressures coming into conflict. Canada's geography would warrant more cooperation on the part of Canada with the U.S. militarily for an optimal deployment of a defensive system but internal political pressure on decision makers to retain Canadian sovereignty over its territory would demand less U.S. influence in Canada. Searching out a compromise position for Canada's role in a NORAD attuned to U.S. defensive needs will be the major problem facing the alliance in the future. NATO will lose the guarantee for its security with the deployment of an effective BMD system and will be forced to depend on its conventional forces to a greater degree than at present. The flexible response triad will become a dyad with the deployment of a Soviet BMD system and Britain and France will no longer be able to maintain an independent nuclear force for political or strategic reasons. NATO will then have to adopt a strategy more effective than forward defence and will have to rely on conventional forces to implement it.

Overall, based on the author's speculation, a shift to a space based defensive system will require substantial changes in the balance and structure of present superpower forces and will require the demise of the present nuclear deterrent strategy. As stated earlier though, the conclusions in this thesis are not based on fact but on speculation based on what is hoped are logical analysis and extrapolation of trends and data. This factor makes it difficult to be proven wrong in the near future but inspires argument through disagreement.

Hopefully the disagreement will be with the strategy that was chosen as the successor to deterrence and not with the idea that deterrence, as exemplified by MAD, will be or requires to be succeeded. It is possible that certain assumptions are incorrect and the pressure for a new strategy will not be defence oriented or oriented towards a space based BMD system but oriented in another direction away from deterrence or defence. Regardless, the important point is that the morally repugnant strategy of nuclear deterrence should be replaced.

Mankind's history has been accentuated by wars and will continue to be as long as there are two opposing ideologies, religions, cultures, races, languages, and so on. The list is unending. War is endemic to mankind but mankind has survived and will continue to survive if the present nuclear weapons and strategy are defeated and replaced respectively. Nuclear technology has been developed and has been with mankind for over forty years. It is not possible to destroy the knowledge gained after so many years and therefore it is necessary to make the knowledge valueless by developing, in poetic terms, a shield to the nuclear sword. In this way change can be wrought upon a strategy that is antithesis to all precepts of war or humanity.

Under the present strategy, 'success' in a superpower nuclear confrontation, would see the direct destruction of the Northern hemisphere and the indirect destruction of the Southern hemisphere by means of fallout or the controversial nuclear winter. Millions upon millions of people would perish and Western society would cease to exist. There is no doubt as to the immorality of such a strategy and the people who would see it come to its logical conclusion in a nuclear holocaust. Decision makers in the U.S. and the U.S.S.R. are therefore confronted with a moral dilemma as to what to do. They can espouse MAD to deter the opponent and yet their rule is based on the assumption that their society must survive, not face nuclear annihilation. It is this factor which has probably propelled the U.S., under Reagan to establish a SDI and it is probably a consequence of the moral abhorrence of MAD and all it entails, that the general population seems to be supporting the shift towards the defence.

For whatever reason, the shift away from MAD can only be applauded. The less chance of nuclear war, the better. Even though the chances of conventional war could increase, the level of destruction of such a war could never match that of even a limited nuclear war, however one defines that. Perhaps it is all wishful thinking and the ideas encapsulated in this thesis will be proven wrong, but it is better to be optimistic than to think there is no defence, nor will there ever be, against nuclear weapons. If nuclear weapons and MAD are the epitome of human endeavour, mankind's future can only be a short one.

Bibliography

Adelman, K.L. "Arms Control With and Without Agreements," *Foreign Affairs*. 63(Winter 1984/85), 240-263.

Aldridge Jr., E.C. "Defense In The Fourth Medium," *Defense*. (January 1983), pp. 2-10.

Alford, J.A., (ed.). *The Impact of New Military Technology*. Westmead: Gower Publishing Company Ltd., 1981.

Andelman, D.A. "Space Wars," *Foreign Policy*. 44(Fall 1981), 94-106.

Art, R.J., Jervis, R. *International Politics*. 2nd ed. Boston: Little, Brown and Company, 1985.

Art, R.J., Waltz, (ed.). *The Use of Force*. Boston: Little, Brown and Company, 1971.

Associated Press. "Soviets vow to match Star Wars," *The Globe and Mail.* (22 February 1985), p. 8.

Baylis, J., *et al*. *Contemporary Strategy*. New York: Holmes & Meier Publishers, Inc., 1975.

Beaufre, A. *Introduction To Strategy*. New York: Frederick A. Praeger, Inc., 1965.

Beaufre, A. *Deterrence and Strategy*. London: Faber & Faber, 1965.

Beckett, B. *Weapons of Tomorrow*. London: Orbis Publishing, 1982.

Bellany, I., Blacker, C.D., (ed.). *Antiballistic Missile Defence in the 1980s*. London: Frank Cass and Company, 1983.

Bennell, B., "Soldiers fear loss of advantage at talks," *The Globe and Mail*. (07 January, 1985), p. 4.

Bertram, C., (ed.). *Strategic Deterrence in a Changing Environment*. Westmead: Gower Publishing Company Ltd., 1981.

Bertram, C., (ed.). *New Conventional Weapons and East-West Security*. London: The MacMillan Press Ltd., 1978.

Best, J., "Canada-U.S. air defence deal near," *The Ottawa Citizen*. (25 February 1984).

Bethe, H., "The Case Against Laser ABM Development," *Laser Focus/ Electro-Optics*. (March 1984), pp. 10, 12, 143-152.

Bethe, H., *et al.*,"Space-based Ballistic Missile Defense," *Scientific American*. 251(October 1984), 39-49.

Blake, B., "Beyond the horizon-a new concept in detection," *Jane's Defence Weekly*. (17 March 1984).

Boraiko,A., "The Laser: A Splendid Light," *The National Geographic*. 165(March 1984), 335-363.

Brzezinski, Z., *et al.*, "Defense In Space Is Not Star Wars," *New York Times Magazine*. (27 January 1985), pp. 28-29, 46-51.

Cameron, N. *The Global Balance of Power*. Leeds: University of Leeds, 1981.

Canada. Department of External Affairs,"NORAD Agreement Renewal," *Communique*. 23(11 March 1981), 30-36.

Canada. Department of National Defence, "Speaking Notes for the Minister of National Defence at the signing ceremony for renewal of the North American Aerospace Defence Command (NORAD) Agreement," (11 March 1981).

Canadian Delegation To NATO. *Canada and NATO Background Information Papers*. Brussels: NATO Information Service, 1977.

Canan, J. *War In Space*. New York: Harper & Row, Publishers, 1982.

Covault, C., "Space Command Seeks ASAT Laser," *Aviation Week & Space Technology*. 118(21 March 1983), 18-19.

Covault, C., "Soviet Antisatellite Treaty Raises Verification Issue," *Aviation Week & Space Technology*. 119(29 August 1983), 20-22.

Cox, D., "Canadian-American military relations: some present trends and future possibilities," *International Journal*. 36(Winter 1980-1981), 91-116.

Critchley, W.H., "Polar Deployment of Soviet Submarines," *International Journal*. 39(Autumn 1984), 828-865.

Cunningham, A.M., Fitzpatrick, M. *Future Fire*. New York: Warner Books Inc., 1983.

Dahlitz, J., "Arms control in outer space," *World Today*. 38 (April 1982), 154-160.

Daniel, D.C., (ed.). *International Perceptions of the Superpower Military Balance*. New York: Praeger Publishers, 1978.

Davidson, J., "BMD: Star wars in perspective," *Aerospace America*. (January 1984), pp. 78-83.

Davis, B.L., "Strategic Air Command Peace Is Its Profession," *Defense*. (November/December 1984), pp. 41-48.

Deitchman, S.J. *Military Power and the Advance of Technology*. Boulder: Westview Press, 1983.

Din, A.M., "Stopping the Arms Race in Outer Space," *Journal of Peace Research*. 20(1983), 221-225.

Dougherty, J.E., Pfaltzgraff, R.L. *Contending Theories of International Relations*. 2nd ed. New York: Harper & Row, Publishers, Inc., 1981.

Draper, T., "Nuclear Temptations," *The New York Review*. (19 January 1984), pp. 42-50.

Dupuy, R.E., Dupuy, T.N. *The Encyclopedia of Military History*. New York: Harper & Row, Publishers, 1970.

Freedman, L. *The Evolution of Nuclear Strategy*. New York: St. Martin's Press, 1981.

Gaddis, J.L. *Russia, The Soviet Union and the United States: An Interpretive History*. New York: John Wiley and Sons, Inc., 1978.

Garfinkle, A.M., "The Politics of Space Defense," *Orbis*. 28 Summer 1984), 240-256.

Garwin, R.L., *et al.*, "Antisatellite Weapons," *Scientific American*. 250(June 1984), 45-55.

Garwin, R.L., Pike, J., "History and Current Debate," *Bulletin of the Atomic Scientists*. 40(May 1984), 2S-11S.

George A.L., Smoke, R. *Deterrence in American Foreign Policy: Theory and Practice*. New York: Columbia University Press, 1974.

Goedhuis, D., "The Present State of International Relations in Outer Space," *International Relations.* 7(May 1983), 2284-2303.

Government of Canada. *Statement on motions on air defence modernization by the Deputy Prime Minister and Minister of National Defence, the Honourable Erik Nielsen*. Ottawa: Department of National Defence, 1985.

Graham, D.O. The Non-Nuclear Defense of Cities. Cambridge: Abt Books, 1983.

Graham, D.O. High Frontier A New National Strategy. Washington: Heritage Foundation, 1982.

Gray, C.S., "Why an ASAT treaty is a bad idea," Aerospace America. (April 1984)pp. 70-74.

Gray, C.S., "Canada and NORAD: A Study in Strategy," Behind The Headlines. 31(June 1972), 1-19.

Gray, C.S., "The Urge to Compete: Rationales for Arms Racing," World Politics. 26(Jun 1974), 207-233.

Gray, C.S., "Deterrence, Arms Control and the Defense Transition," Orbis. 28(Summer 1984), 227-239.

Gray, C.S. American Military Policy. Cambridge: Abt Books, 1982.

Griffith, P. Forward into Battle. Sussex: Antony Bird Publications Ltd., 1981.

Gutteridge, W., Taylor, T., (ed.). The Dangers of New Weapon Systems. London: The MacMillan Press Ltd., 1983.

Hafner, D.L., "Averting a Brobdingnagian Skeet Shhot," International Security. 5(Winter 1980-81), 41-60.

Hecht, J., "The Outlook for Government Laser Research," Lasers & Applications. (Jun 1984), 77-82.

Henes, R.T., "Aerospace Defense Command: Keeping Watch on the Skies of North America," Defense. (November/December 1984), pp. 57-64.

Hill, R. Political Consultation in NATO. Toronto: Canadian Institute of International Affairs, 1978.

Howard, M. War in European History. Oxford: Oxford University Press, 1976.

The International Institute for Strategic Studies. The Military Balance 1983-1984. London: IISS, 1983.

Jasani,B., (ed.). Outer Space-A New Dimension of the Arms Race. London: Taylor & Francis Ltd., 1982.

Jasani, B., Lunderius, M.A., "Peaceful Use of Outer Space-Legal Fiction and Military Reality," Bulletin of Peace Proposals. 11(1980), 57-69.

Jasani, B., "Space: Battlefield of the Future?," Futures. 14(October 1982), 435-447.

Jones, R.V. Future Conflict and New Technology. Beverly Hills: Sage Publications, 1981.

Kahan, J.H. Security In The Nuclear Age. Washington: The Brookings Institution, 1975.

Kennan, G.F., et al., "The President's Choice: Star Wars or Arms Control," Foreign Affairs. 63(Winter 1984/85), 264-278.

Keyworth II, G.A., "A sense of obligation-the Strategic Defense Initiative," Aerospace America. (April 1984), 56-62.

Klass, P.J., "House Unit Alters Lasers Goals," Aviation Week & Space Technology. 114(26April 1982), 17-18.

Kozyrev, A., "No Arms Race in Outer Space," International Affairs. 6(July 1982), 85-90.

Lamberson, D.L., " DoD's Directed Energy Program," Defense. (June 1983), pp. 16-21.

Legault, A., Lindsey, G. The Dynamics of the Nuclear Balance. Ithaca: Cornell University Press, 1976.

Levy, J.S., "The Offensive/Defensive Balance of Military Technology: A Theoretical and Historical Analysis," International Studies Quarterly. 28(June 1984), 219-238.

MacDonald, B., (ed.). Canada's Strategies For Space: A Paradox of Oppurtunities. Toronto: Canadian Institute for Strategic Studies, 1983.

Martin, L. Arms and Strategy. London: Weidenfield & Nicholson, 1973.

McDonald, M., "An Ominous Arctic Shield," Maclean's. 98(04 March 1985), 12-14.

McDougall, W.A., "How Not to Think About Space Lasers," National Review. 35(13 May 1983), 550-581.

McLin, J.B. Canada's ChangingDefence Policy, 1957-1963. Baltimore: John Hopkins Press, 1967.

Millar, T.B. The East-West Strategic Balance. London: George Allen & Unwin Ltd., 1981.

Morgenthau, H.J., "The Four Paradoxes of Nuclear Strategy," American Political Science Review. 58(March 1964), 22-35.

NATO Information Service. NATO Facts and Figures. Brussels: NATO Information Service, 1976.

NATO Information Service. NATO and the Warsaw Pact Force Comparisons. Brussels: NATO Information Service, 1982.

NATO Special Consultative Group. INF: Progress Report to Ministers. Brussels: Nato Press Service, 1983.

NORAD Command,"Canadian Forces Air Command Air Defense Forces," NORAD Fact Sheet. (15 January 1985), pp. 1-2.

NORAD Command, "Cheyanne Mountain Complex," NORAD Fact Sheet. (15 July 1984), pp. 1-9.

NORAD Command, "The NORAD Space Detection and Tracking System," NORAD Fact Sheet. (20 August 1982), pp. 1-12.

NORAD Command, "North American Aerospace Defense Command," NORAD Fact Sheet. (01 November 1984), pp. 1-4.

O'neill, R., Horner, D.M., (ed.). New Directions in Strategic Thinking. London: George Allen & Unwin Ltd., 1981.

Ørvik, N., "NATO: The Role of the Small Members," International Journal. 21(Spring 1966), 173-185.

Payne, K.B., "Strategic Defense and Stability," Orbis. 28(Summer 1984), 215-226.

Payne, K.B., (ed.). Laser Weapons in Space. Boulder: Westview Press, 1983.

Pentagon, "The Star Wars gambit riles the experts," Business Week. (11 April 1983), pp. 30-31.

Piradov, A., "For Peaceful Uses of Outer Space," International Affairs. 7(July 1983), 38-44.

Polmar, N. Strategic weapons: An Introduction. New York: Crane, Russak & Company, Inc., 1975.

Preston, R.A., Wise, S.F. Men in Arms. 4th ed. New York: Holt, Rinehart and Winston, 1979.

Quester, G.H. Offense and Defense in the International System. New York: John Wiley & Sons, Inc., 1977.

Ra'anan, U., Pfaltzgraff, R.L., (ed.). Projection of Power. Hamden: The Shoe String Press, Inc., 1982.

Randolph, A., "USAF Upgrades Deep Space Coverage," Aviation Week & Space Technology. 118(28 February 1983), 57-58.

Rankine Jr., R.R., "Rsearch on technology for strategic defense," Aerospace America. (April 1984), pp. 64-68.

Ritchie, D. Space Wars. New York: Atheneum,1982.

Roberds, R.M., "Introducing the Particle-Beam Weapon," Air University Review. 37(May 1984), 75-84.

Robinson Jr., C.A., "Beam Weapon Advances Emerge," Aviation Week & Space Technology. 119(18 June 1983), 18-21.

Robinson Jr. C.A., "Study Urges Exploiting Of Technologies," Aviation Week & Space Technology. 119(24 October 1983), 50-57.

Robinson Jr., C.A., "Soviets Test New Cruise Missile," Aviation Week & Space Technology. 120(02 January 1984), 14-16.

Robinson Jr., C.A., "Strategic Defense Draws Strong Focus," Aviation Week & Space Technology. 114(13 April 1981), 68-73.

Robinson Jr., C.A., "Shuttle May Aid in Space Weapons Test," Aviation Week & Space Technology. 119(31 October 1983), 74-78.

Robinson Jr., C.A., "GAO Pushing Accelerated Laser Program," Aviation Week & Space Technology. 116(12 April 1982), 16-19.

Robinson Jr., C.A., "Panel Urges Boost Phase Intercept," Aviation Week & Space Technology. 119(05 December 1983), 50-61.

Robinson Jr., C.A., "Panel Urges Defense Technology Advances," Aviation Week & Space Technology. 119(17 October 1983), 16-18.

Rosas, A., "The Militarization of Space and International Law," Journal of Peace Research. 20(1983), 357-364.

Russell, W.N., "The Canadian Forces: Whither in Space?," Canadian Defence Quarterly. 13(Autumn 1983), 10-14.

Russett, B. The Prisoners of Insecurity. San Francisco: W.H. Freeman and Company, 1983.

Schauer, W.H., "Outer Space: The Boundless Commons?," *Journal of International Affairs*. 31(1977), 67-80.

Sellar, D., Butters, B., "US cuts off funding for outdated radar line," *The Ottawa Citizen*. (17 November 1983).

Sheehan, M. *The Arms Race*. Oxford: Martin Robertson & Company, Ltd., 1983.

Sivachev, N.V., Yakovlev, N.N. *Russia and the United States*. Chicago: University of Chicago Press, 1979.

Smernoff, B.J., " Laser Weapons in Space," *Air University Review*. 33(March/April 1982), 3-16.

Special Committee of the Senate on National Defence. *Canada's Territorial Air Defence*. Ottawa: Minister of Supply and Services, 1985.

Special Report, "Putting America's Defense Into Orbit," *Business Week*. 20(June 1983), 52-53+.

Steinberg, G.M. *Satellite Reconnaissance*. New York: Praeger Publishers, 1983.

Steinberg, G.M., "The Militarization of Space," *Futures*. 14(October 1982), 374-392.

Stoehrmann, K.C., "Aerospace Strategy in the Postnuclear Age," *Air University Review*. 34(November/December 1982), 76-81.

Subrahmanyam, K., "The Star Wars Delusion," *World Press Review*. 30(June 1983), 21-24.

Sutherland, R.J., "Canada's Long Term Strategic Situation," *International Journal*. 17(Summer 1962), 199-223.

Tobias, S., *et al*. *What Kinds of Guns Are They Buying For Your Butter*. New York: William Morrow and Company, Inc., 1982.

Tsipis, K. *Arsenal: Understanding Weapons inthe Nuclear Age*. New York: Simon and Shuster, 1983.

Tsipis, K., "Laser Weapons," *Scientific American*. 245(December 1981), 51-57.

Ulsamer, E., "The Battle For SDI," *Airforce*. 68(February 1985), 44-53.

U.S. Defense Intelligence Agency. Soviet Military Space Doctrine. Washington: Defense Intelligence Agency, 1984.

U.S. Department of Defense. Soviet Military Power. Washington: Government Printing Office, 1984.

U.S. Government. The President's Strategic Defense Initiative. Washington: Government Printing Office, 1985.

U.S. Space Command, "Consolidated Space Operations Center," Space Command Fact Sheet. (May 1984), pp. 1-5.

U.S. Space Command, "Air Force Space Command," Space Command Fact Sheet. (15 July 1984), pp. 1-7.

U.S.S.R. Ministry of Defense. Whence The Threat To Peace. Moscow: Military Publishing House, 1982.

Velocci, T., "Star Wars Weaponry," International Combat Arms. (January 1985), pp. 28, 90-96.

Velikhov, Y.P., "Effect on strategic stability," Bulletin of the Atomic Scientists. 40(May 1984), 12S-15S.

Washington, "Defensive Technologies Study Sets Funding Profile Options," Aviation Week & Space Technology. 119(24 October 1983), 50-51.

Washington, "Soviets Integrating Space in Strategic War Planning," Aviation Week & Space Technology. 118(14 March 1983), 110-111.

Washington, "USAF Studies Hypervelocity Technology," Aviation Week & Space Technology. 119(05 December 1983), 62-68.

Washington, "DARPA Chief Foresees More Satellite Targeting," Aviation Week & Space Technology. 119(19 December 1983), 27.

Washington, "U.S. Vigilance Over Soviet Space Activities Increased," Aviation Week & Space Technology. 117(04 October 1982), 53-54.

Wohlstetter, A., "The Delicate Balance of Terror," Foreign Affairs. 37(January 1959), 211-234.

Wright, G., "NATO In The New International Order," Behind The Headlines. 36(1978), 1-27.

Wright, G. The Ordeal of Total War 1939-1945. New York: Harper & Row, Publishers, Inc., 1968.

anon., "No borders in a nuclear war," *Commentary*. 39(April 1983), 40-41.

anon., "Onward and upward with space defencse," *The Bulletin of the Atomic Scientists*. 39(June/July 1983), 4-8.

anon., "Peace in space?," *Economist*. 288(27 August 1983), 11-12.

anon., "Laser weapons Come Into Focus," *Economist*. 288(02 July 1983), 76.

anon., "Satellites in Space," *Economist*. 288(21 May 1983), 27-28.

anon., "Knocking Satellites Down," *Economist*. 288(21 May 1983), 30.

anon., "Laser weapons: From science fiction to fact," *Business Week*. (26 July 1982), 66-68.

anon., "Laser Weapons Acquire Strategic Focus," *Laser Focus/Electro-Optics*. (February 1984), pp. 18-26.

APPENDIX I

List of Maps

A. Inner contour for the SS-N-8 aimed at North American targets.

B. Inner and outer contour for SS-N-8 aimed at European targets.

C. Inner and outer contour for SS-NX-17 aimed at North American targets.

D. Inner and outer contour for SS-NX-17 aimed at European targets.

E. Inner contour for SS-N-18 aimed at North American targets.

F. Inner and outer contour for SS-N-18 aimed at European targets.

Legend for Polar Projection Map

A. Tashkent
B. Sverdlovsk
C. Gorki
D. Norilsk
E. Moscow
F. Odessa
G. Kiev
H. Leningrad
I. Murmansk
J. Vladivostok

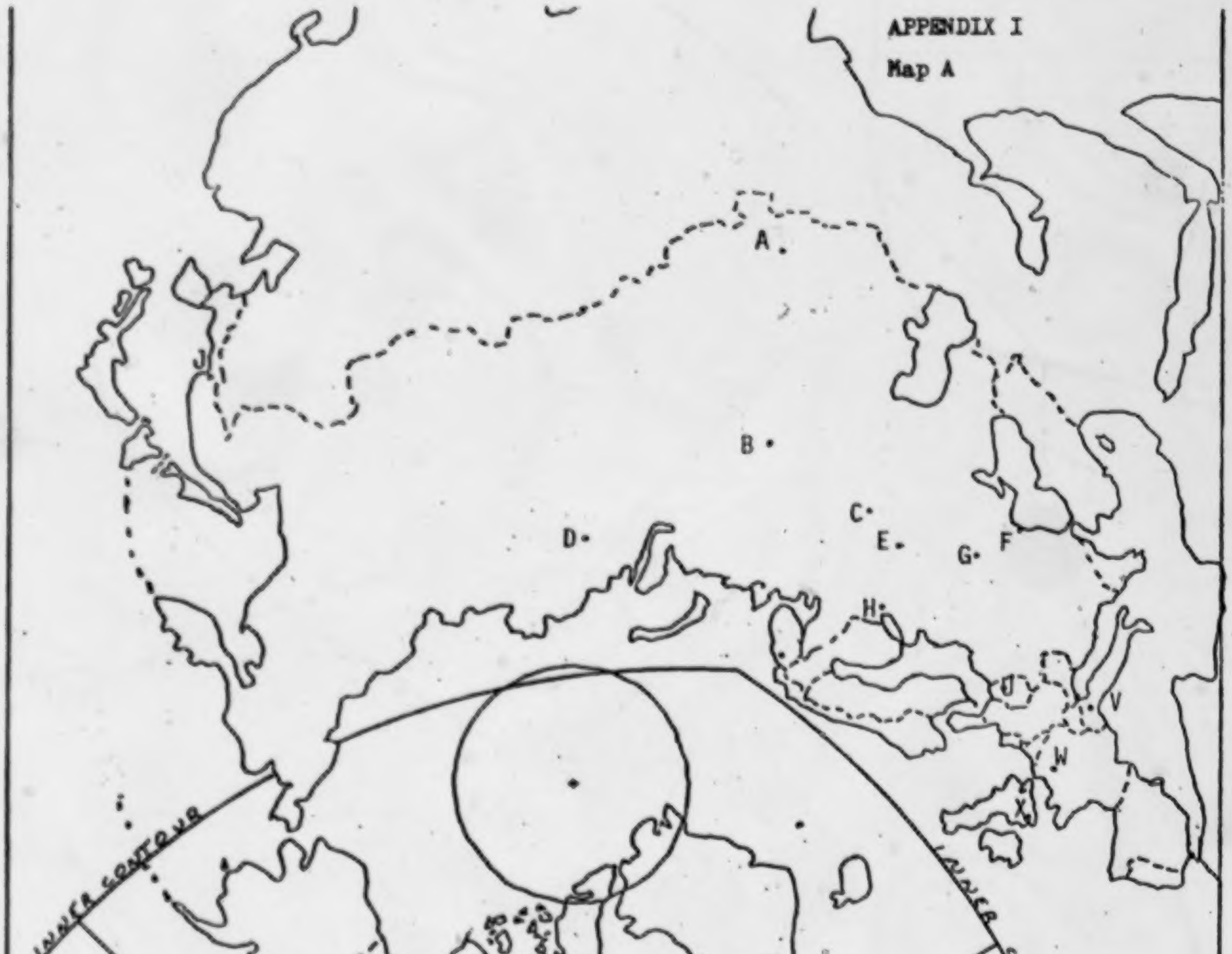
K. Vancouver
L. Ottawa

M. San Fransisco
N. Los Angeles
O. Denver
P. Chicago
Q. New York
R. Philadelphia
S. Washington
T. Houston

U. Berlin
V. Milan
W. Paris
X. London
Y. Petropavlovsk

APPENDIX I

Map A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INNER CONTOUR
INNER CONTOUR FOR ALL INLAND TARGETS
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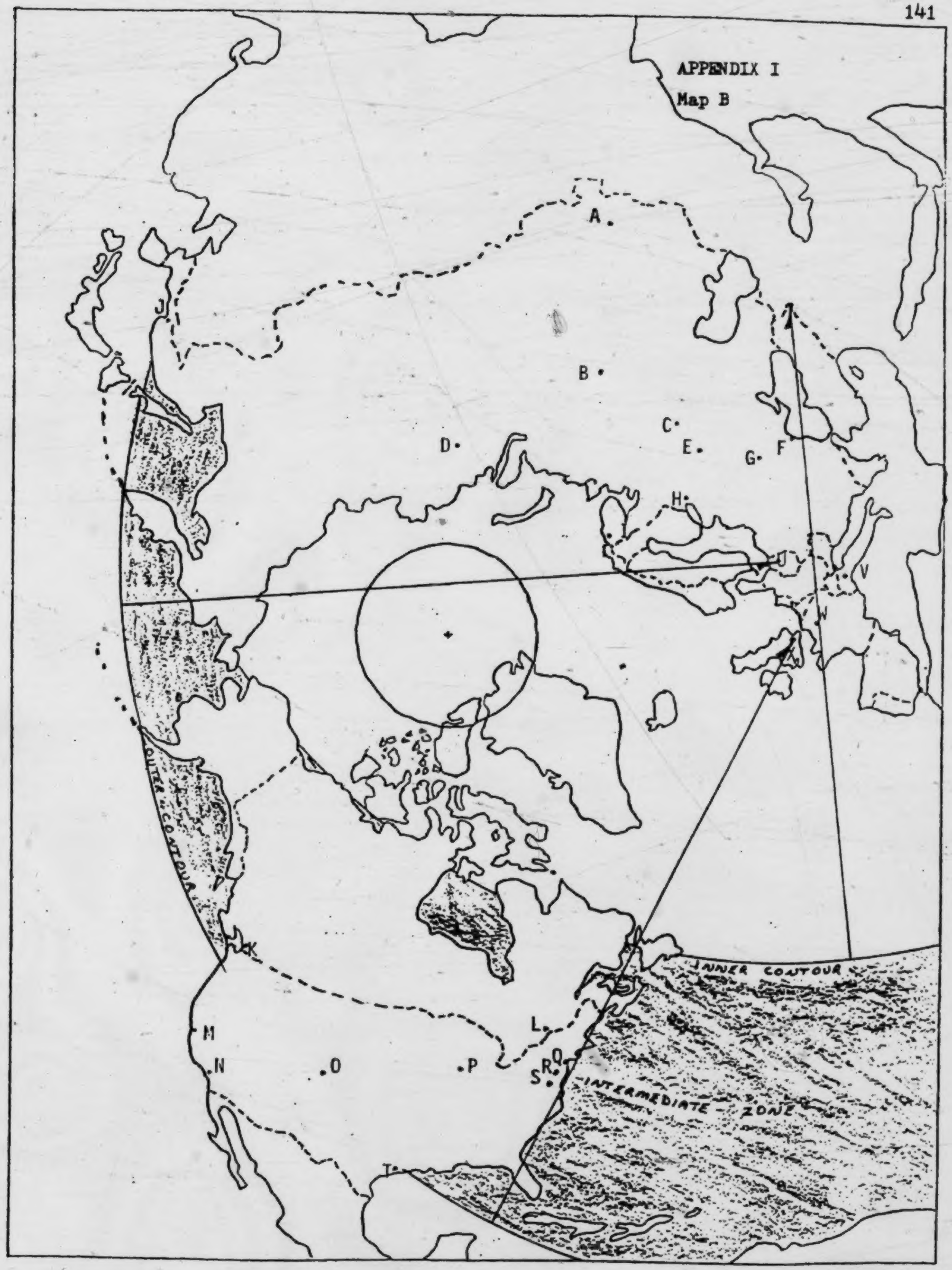
Scale: 1: 60 000 000

SS-N-8 Range=8000Km

APPENDIX I

Map B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INTERMEDIATE ZONE
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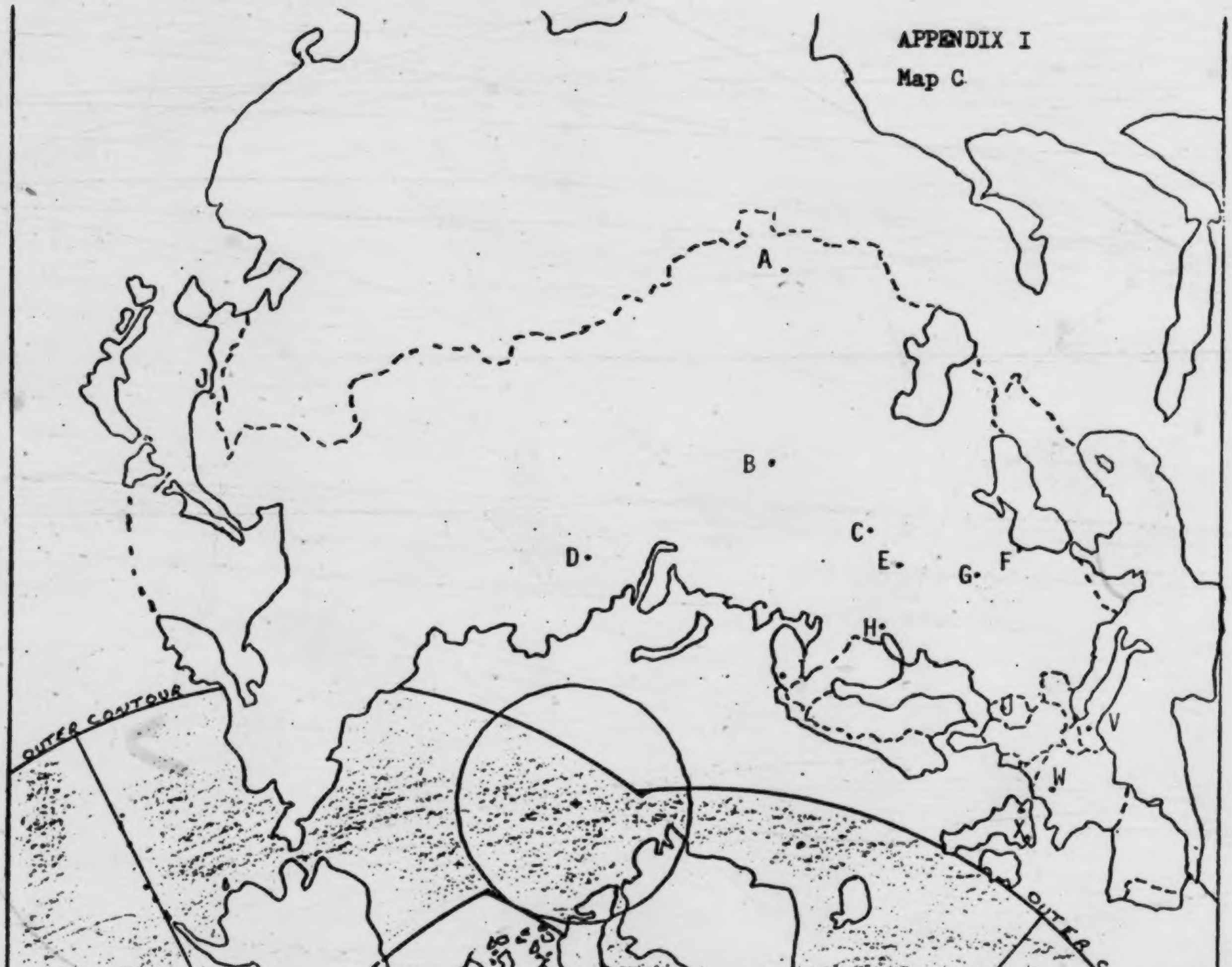
Scale: 1: 60 000 000

SS-N-8 Range=8000Km

APPENDIX I

Map C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OUTER CONTOUR
WESTERN INTERMEDIATE ZONE FOR INLAND TARGETS
EASTERN INTERMEDIATE ZONE FOR INLAND TARGETS
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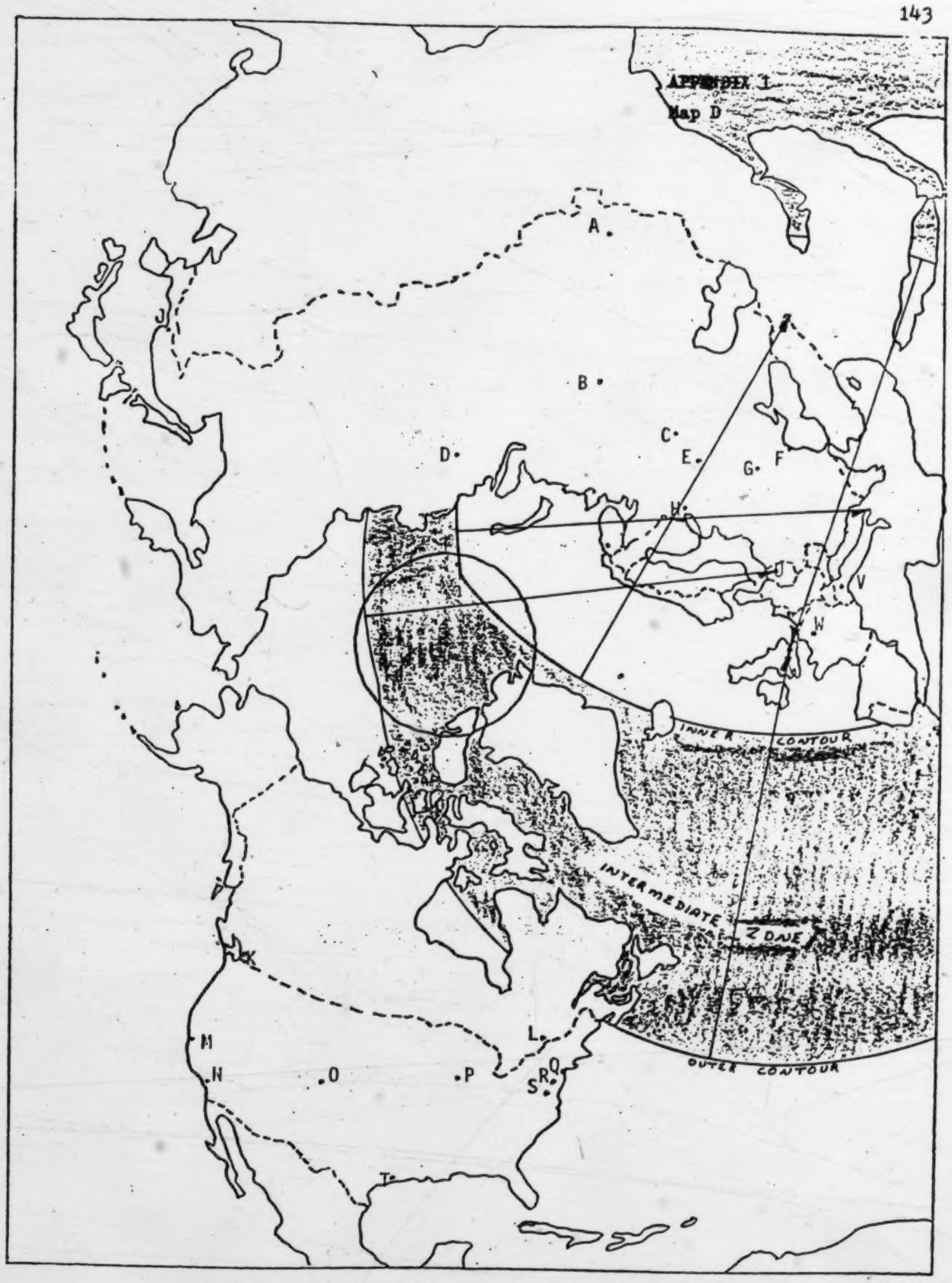
INNER CONTOUR
INNER CONTOUR

Scale: 1: 60 000 000

SS-NX-17 Range=5000Km

APPENDIX 1

Map D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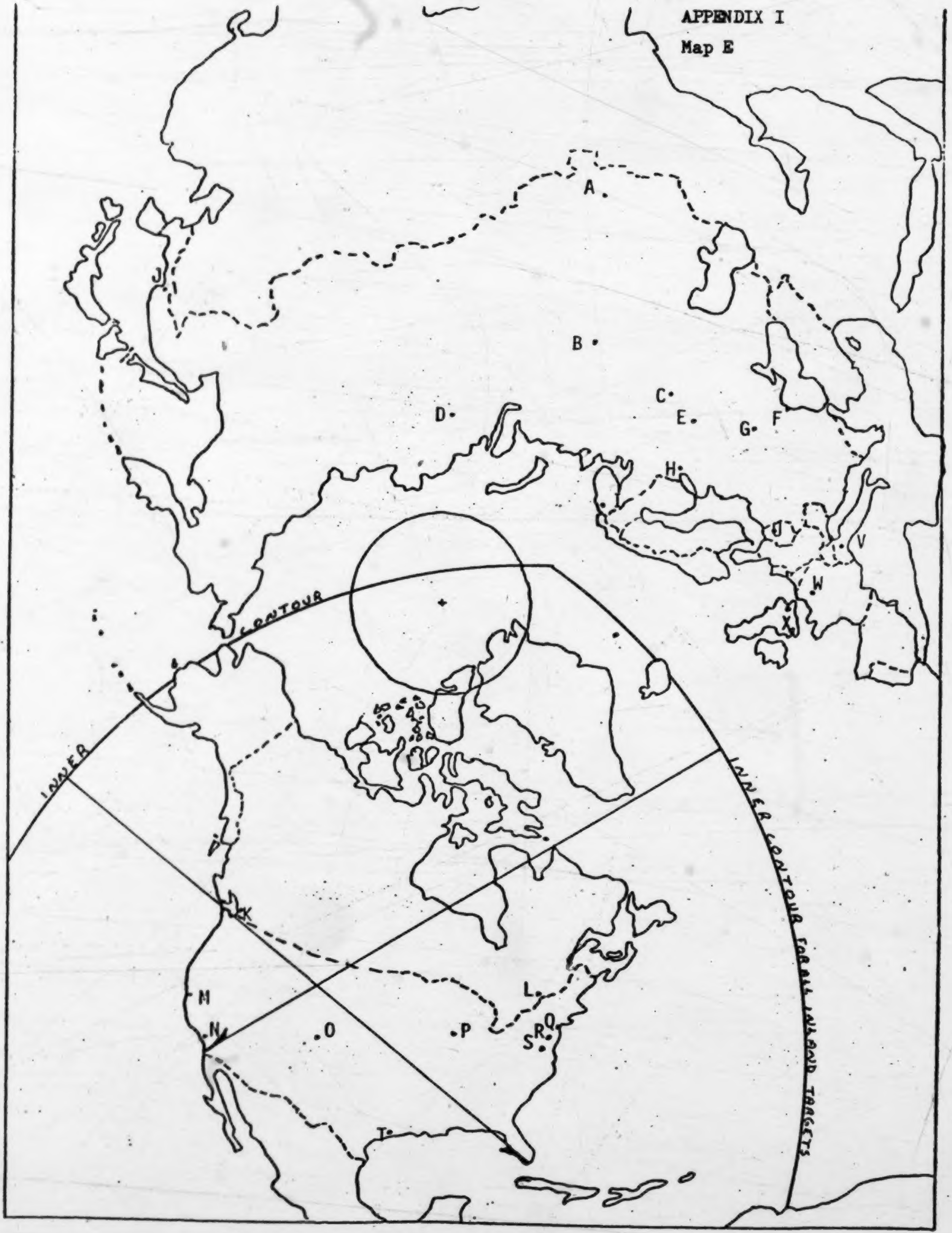
INNER CONTOUR
INTERMEDIATE ZONE
OUTER CONTOUR

Scale: 1: 60 000 000

SS-NX-17 Range=5000Km

APPENDIX I

Map E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INNER CONTOUR
INNER CONTOUR FOR ALL INLAND TARGETS
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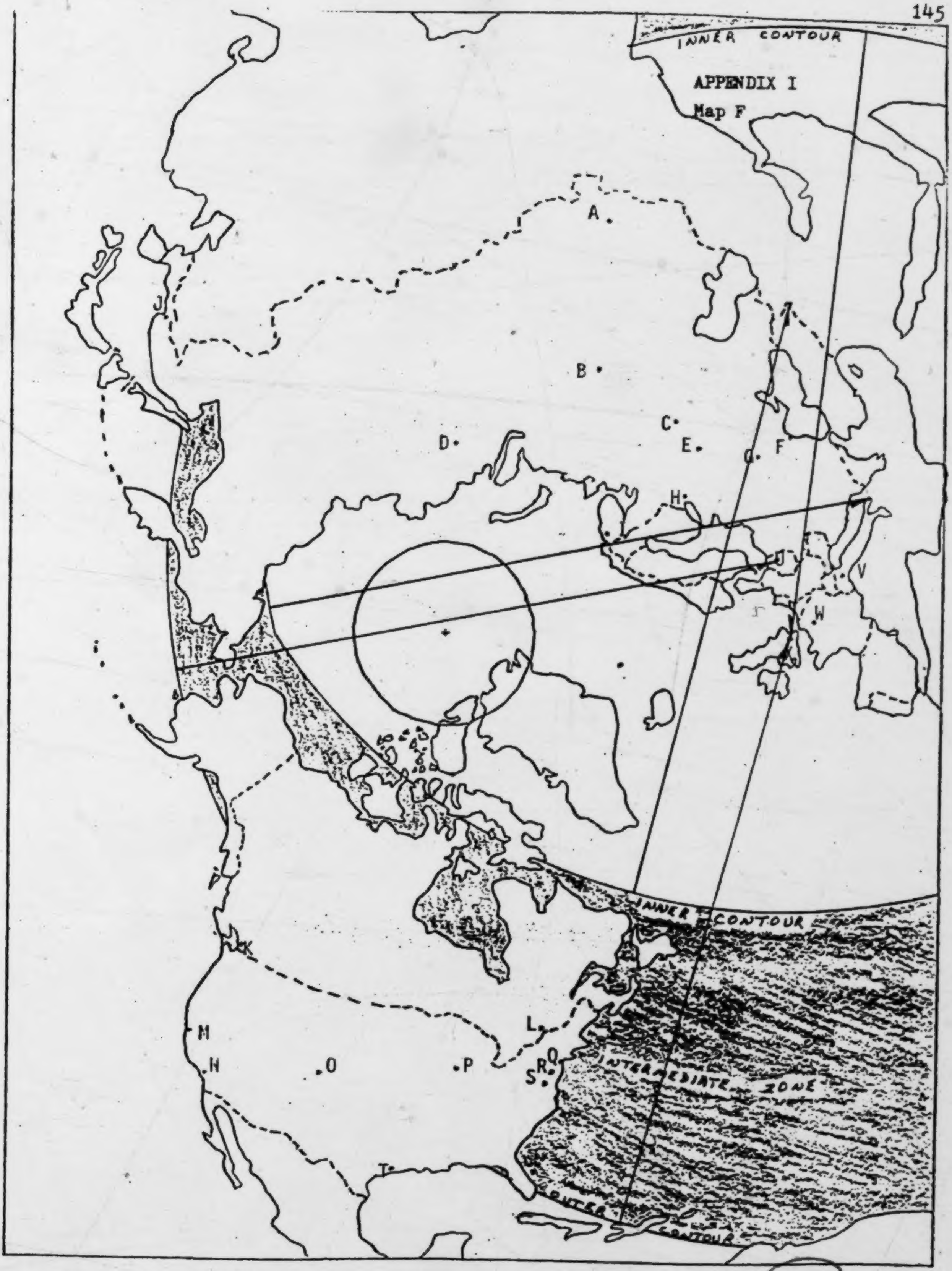
Scale: 1: 60 000 000

SS-N-18 Range=7400Km

APPENDIX I

Map F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INTERMEDIATE ZONE
T
OUTER CONTOUR

Scale: 1: 60 000 000

SS-N-18 Range=7400Km